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THE ANATOMICAL RECORD

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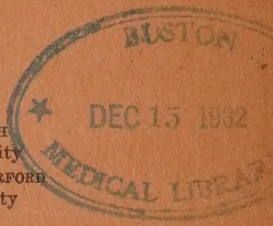

NOVEMBER 25, 1932

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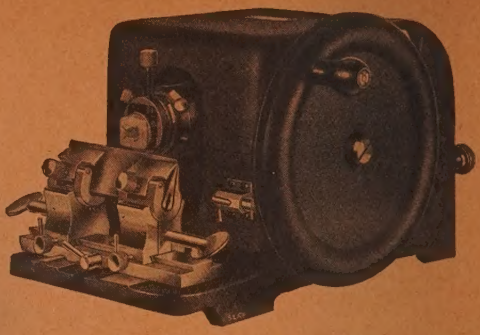

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THE ANATOMICAL RECORD, VOL. 54, NO. 3, SUPPLEMENT
NOVEMBER, 1932

PROGRAM AND ABSTRACTS FOR THE THIRTIETH ANNUAL MEETING OF THE AMERICAN SOCIETY OF ZOÖLOGISTS

ATLANTIC CITY, N. J., DECEMBER 28, 29, 30, AND 31, 1932

The following titles and abstracts make up the 1932 program of the American Society of Zoölogists. They were received on or before November 10th by the Secretary of the Society, and have been arranged according to the accepted program rules.

The abstracts are in the form contributed by their authors. They have been edited only to secure a uniform system of titles and style and to reduce length when obviously overlong. Their arrangement and the planning of the program can be done only after the titles are all at hand and must be greatly rushed in order to obtain publication before the meetings. The Wistar Institute is scheduled to mail out this issue of The Anatomical Record three weeks, to the day, after receiving the manuscript. All proofreading will be done there. The Institute deserves great credit for making possible the early publication and distribution of this material.

These abstracts and the accompanying data are presented as a part of the official proceedings of the 1932 meetings of the Society. The minutes of the meetings, a list of the officers of the Society for 1933, a list of members, the constitution and by-laws, and historical data will appear in the January number of this journal.

PROGRAM

An alphabetical author index of all persons contributing to the program will be found on pages 116–120. Data concerning rooms, not given here, may be found in the program of the American Association for the Advancement of Science.

All sessions of the American Society of Zoölogists will be held in the Municipal Auditorium of Atlantic City. The room assignments for various sections are given below.

Any zoölogical exhibits of interest either to zoölogists or to the public in general, but not included in the demonstration program of the American Society of Zoölogists, may be arranged at the Atlantic City meeting in conjunction with the American Association exhibit in the Municipal Auditorium. For arranging such exhibits members should communicate with Mr. F. C. Brown, Chairman, Scientific Exhibits Committee, A.A.A.S., Washington.

For those zoölogists who can arrange to stay in Atlantic City another day, a field trip is being planned for Saturday, December 31st. Due to a crowded program it was impossible to arrange the trip at any other time.

WEDNESDAY, DECEMBER 28TH

10.00 A.M. *a.* Comparative and General Physiology. Papers 1 to 13, inclusive. Committee room 13, Municipal Auditorium.

b. Embryology. Papers 113 to 121, inclusive, also paper no. 128, if time permits. Committee room 9, Municipal Auditorium.

1.30 P.M. *a.* Demonstrations and exhibits. Presentation of all papers listed 'By demonstration.' At 2.30, Doctor Chambers will show 2 reels of motion pictures of the developing Arbacia egg. Paper no. 122. Room to be announced later—Municipal Auditorium. (See A.A.A.S. General Program.)

4.30 P.M. General A.A.A.S. lecture by Carl C. Speidel on growing nerves, to be illustrated by motion pictures. Municipal Auditorium.

THURSDAY, DECEMBER 29TH

10.00 A.M. *a.* Comparative and General Physiology. Papers 14 to 27, inclusive. Committee room 13, Municipal Auditorium.

b. Cytology. Papers 136 to 145, inclusive. Committee room 9, Municipal Auditorium.

c. Joint session with the Ecological Society of America. Papers 200 to 203, inclusive, and papers by members of the Ecological Society of America. Committee room 7, Municipal Auditorium.

2.00 P.M. *a.* Business session of Section F. Committee room 13, Municipal Auditorium.

2.10 P.M. Business session of the American Society of Zoölogists. The proposed new constitution will be presented for action. Committee room 13, Municipal Auditorium.

3.00 P.M. *a.* Comparative and General Physiology. Papers 28 to 41, inclusive. Committee room 13, Municipal Auditorium.

b. Protozoölogy, anatomy, parasitology, and miscellaneous. Papers 170–173, 192–194, 196–197, 208–210, inclusive. Committee room 9, Municipal Auditorium.

6.30 P.M. Zoölogists' dinner. Ambassador Hotel. The dinner address will be given by Charles Zeleny, Vice-President of Section F, on "Genetics and embryology." All biologists are cordially invited.

FRIDAY, DECEMBER 30TH

10.00 A.M. Symposium on 'Embryonic determination.' Invitational papers will be presented as follows: "Mosaic versus equipotential development," E. G. Conklin, Princeton University. "Determination in sea-urchin eggs," D. H. Tennent, Bryn Mawr College. "Correlation in growth and development," R. G. Harrison, Yale University. "On the origin and differentiation of the sex gland," B. H. Willier, University of Chicago. "Functional adaptation and the role of ground substances in development," P. Weiss, Yale University. A general discussion will follow the presentation of each paper.

2.00 P.M. Joint session with the American Society of Naturalists, the Botanical Society of America, and the Genetics Society of America. Committee room 13, Municipal Auditorium.

SATURDAY, DECEMBER 31ST

9.00 A.M. Field trip to oyster industry. Detailed announcements will be made in Atlantic City.

LIST OF TITLES

COMPARATIVE AND GENERAL PHYSIOLOGY

Read

1. Laboratory culture of the drone fly, Eristalis tenax. William L. Dolley, Jr., C. C. Hassett, and W. J. Bowen, University of Buffalo. (Lantern; 5 min.)
2. Mechanisms of heat resistance in a pigment-bearing insect. Nellie M. Payne, University of Pennsylvania. (Introduced by H. B. Baker.) (Lantern; 15 min.)
3. The growth of the mussel, Mytilus edulis, at Woods Hole, Massachusetts. Oscar W. Richards, Yale University. (Lantern; 12 min.)
4. The effect of temperature and the acetate radical on growth of Euglena gracilis. Theo. L. Jahn, Yale University. (Introduced by L. L. Woodruff.) (Lantern; 10 min.)
5. The effect of alternating temperatures on the pupal development of Drosophila melanogaster. Daniel Ludwig and Raymond M. Cable, New York University. (Lantern; 15 min.)
6. New data with possible bearings upon Robertson's theory of allelocatalysis. Maurita McPherson, George A. Smith, and A. M. Banta, Brown University and Carnegie Institution. (Lantern; 15 min.)
7. Sex ratio in the domestic fowl. T. C. Byerly, E. McNally, and M. A. Jull, U. S. Department of Agriculture. (Lantern; 15 min.)
8. Further studies on the longevity and swimming ability of spermatozoa. B. H. Grave, DePauw University. (Lantern; 10 min.)
9. Effect of acetylsalicylic acid on germ cells and early developmental stages of Arbacia. Robert A. Budington, Oberlin College. (Lantern; 10 min.)
10. The effect of nursing upon the glutathione concentration of newly born rabbits. Harold Goss and P. W. Gregory, University of California. (Introduced by the Secretary of the Society.) (Lantern; 10 min.)
11. Some pharmacological reactions of Arctomys monax. David I. Macht, Hynson, Westcott, and Dunning, Inc. (Introduced by the Secretary of the Society.) (15 min.)
12. Prolactin, a new and third hormone of the anterior pituitary. Oscar Riddle, Robert W. Bates, and Simon W. Dykshorn, Carnegie Institution. (Lantern; 15 min.)
13. Leg weakness induced by antuitrin, and the regulation of calcium metabolism by iodine. F. E. Chidester, A. L. Ashworth, G. A. Ashworth, and I. A. Wiles, West Virginia University. (10 min.)
14. The preparation of oestrin-free progestin from corpora lutea of swine. Willard M. Allen and Roland K. Meyer, University of Rochester. (Lantern; 15 min.)
15. The precocious development of sexual characters in the fowl by daily injections of hebin. I. The male. L. V. Domm and H. B. Van Dyke, University of Chicago. (Lantern; 7 min.)

16. The precocious development of sexual characters in the fowl by daily injections of hebin. II. The female. L. V. Domm and H. B. Van Dyke, University of Chicago. (Lantern; 8 min.)
17. Pineal implants in rats. G. E. Johnson and E. L. Lahr, Kansas State College. (Lantern; 10 min.)
18. Activity of the heart and movement of blood in the transparent larva of Ammocoetes. J. Frank Daniel, University of California. (Charts; 10 min.)
19. Studies on the physical chemistry of fish hemoglobin. R. W. Root, College of the City of New York. (Introduced by A. C. Redfield.) (Lantern; 15 min.
20. Heteroplastic transplantations of macerated duck-kidney tissue to the chorio-allantoic membrane of the chick. Carl J. Sandstrom and Joseph T. Kauer, New York University. (Introduced by H. W. Stunkard.) (15 min.)
21. Xenoplastic inductions. Oscar Schotté, Yale University. (Introduced by R. G. Harrison. (Lantern; 15 min.) (Also by demonstration.)
22. A reinvestigation of data on regeneration in the carapace of Daphnia magna. B. G. Anderson, Western Reserve University. (Introduced by the Secretary of the Society.) (Lantern; 10 min.)
23. Resorption in the ductuli efferentes of the mouse and its significance for the genital-tract-ligature problem. William C. Young, Brown University, and Anatomical Institute, Freiburg, i. Br. (Lantern; 15 min.)
24. Catalase and oxidative processes in animal tissues as possible factors in adaptation. Hoyt S. Hopkins, New York University. (Lantern; 10 min.) (Also by demonstration.)
25. The effect of hypertonic solutions on the oxygen consumption of a developing egg (Orthoptera). J. H. Bodine, State University of Iowa. (Lantern; 10 min.)
26. Influences of the nervous system and of respiration upon urine formation in the frog. Edward F. Adolph, University of Rochester. (Lantern; 10 min.)
27. The effect of narcotics (urethanes) on bacterial respiration and luminescence. G. Wellford Taylor, Princeton University. (Introduced by E. Newton Harvey. (Lantern; 8 min.)
28. Precipitins and phlogeny in animals. Alan A. Boyden, Rutgers University. (Lantern; 10 min.) (Also by demonstration.)
29. A method of determining interfacial tensions within living cells. E. Newton Harvey and Herbert Shapiro, Princeton University. (Lantern; 7 min.)
30. Transfusion of neurohumoral substances to chromatophores by other means than blood or lymph. G. H. Parker, Harvard University. (Lantern; 15 min.)
31. The crustacean eye hormone and its effect upon the chromatophores of crustaceans, fishes, and amphibians. Earle B. Perkins and Benjamin Kropp, Rutgers University and The Mount Desert Island Biological Laboratory. (15 min.)
32. The responses of caterpillars to sounds. D. E. Minnich, University of Minnesota. (Motion pictures; 12 min.)

33. Visual acuity of the fiddler crab, Uca pugnax. Leonard B. Clark, Columbia University and Union College. (Introduced by James W. Mavor.) (Lantern; 15 min.)
34. The extent of the spectrum for Drosophila and the distribution of stimulative efficiency in it. Lloyd M. Bertholf, Western Maryland College and University of Munich. (Lantern; 15 min.)
35. The rate of light adaptation in the eye of the drone fly, Eristalis tenax. William L. Dolley, Jr., University of Buffalo. (Lantern; 10 min.)
36. Functioning kidney tubules in tissue culture. Robert Chambers, New York University. (Lantern; 10 min.)
37. A micromanipulative study of capillary reactions to mechanical stimulation. B. W. Sweifach and Robert Chambers, New York University. (Lantern; 5 min.)
38. The bio-electric properties of living frog skin. H. B. Steinbach, University of Pennsylvania. (Introduced by L. V. Heilbrunn.) (Lantern; 10 min.)
39. Histological changes in non-regenerating limbs of x-rayed Amblystoma larvae. E. G. Butler, Princeton University. (Lantern; 15 min.)
40. Physiological effects of x-rays on larvae of the mud-dauber wasp, Sceliphron caementarium (Hymenoptera). J. H. Bodine and T. C. Evans, State University of Iowa. (Lantern; 5 min.)
41. The action of ultraviolet rays on Amoeba protoplasm. L. V. Heilbrunn and Kathryn Daugherty, University of Pennsylvania. (Lantern; 5 min.)

By demonstration

42. Demonstration of sperm tubes used in the study of the swimming ability of spermatozoa. B. H. Grave, DePauw University.
43. Some easily made and inexpensive physiological apparatus. James W. Mavor, Union College.
44. Hydrogen-ion activity changes in Galleria mellonella during metamorphosis as determined by a glass electrode with microvessel. Ivon R. Taylor and James H. Birnie, Brown University. (Introduced by the Secretary of the Society.)
45. The measurement of the growth of mussels from x-ray pictures of the shells. Oscar W. Richards, Yale University.

By title

46. Attempts to end the dormancy period of some Cladocera sexual eggs. Thelma R. Wood and A. M. Banta, Brown University and Carnegie Institution.
47. Is the usual balanced physiological medium suitable for avascular fresh-water animals? Alford Hetherington, Johns Hopkins University. (Introduced by S. O. Mast.)
48. Growth retardation with suboxidized cystin. Frederick S. Hammett, Marine Experiment Station, Res. Inst. Lankenau Hosp., North Truro, Massachusetts.
49. The effect of –SH on the growth of Chilomonas paramecium. Theo. L. Jahn, Yale University. (Introduced by the Secretary of the Society.)

50. The effect of certain organic-acid radicals on growth of Euglena gracilis. Theo. L. Jahn, Yale University. (Introduced by the Secretary of the Society.)
51. Experimental production of cataract in trout. Walter N. Hess, Hamilton College.
52. Changes in the glucose content of the Japanese beetle (Popillia japonica Newman) during metamorphosis. Daniel Ludwig, New York University.
53. Possible factors in the molting mechanism of newts. A. E. Adams and M. C. Grierson, Mount Holyoke College.
54. Molting of newts under laboratory conditions. Margaret C. Grierson, Mount Holyoke College. (Introduced by A. E. Adams.)
55. A quantitative study of the oxygen consumption of single developing eggs (Orthoptera). J. R. Burkholder, State University of Iowa. (Introduced by J. H. Bodine.)
56. Studies on the oxygen consumption of fresh-water fishes. H. C. Burdick, State University of Iowa. (Introduced by J. H. Bodine.)
57. Effect of sublethal concentrations of sodium chloride on the oxygen consumption of anuran larvae. W. B. Buchanan, New York University. (Introduced by O. M. Helff.)
58. The blood and blood-forming organs of the salamander, Plethodon cinereus. H. E. Jordan, University of Virginia.
59. The hemocytopoietic effect of liver extract in the frog. H. E. Jordan and J. R. Shanklin, University of Virginia.
60. Hydrogen-ion concentration of the blood of anuran larvae during involution. O. M. Helff, New York University.
61. Studies on the pH changes of body fluids during metamorphosis in an insect, Sceliphron caementarium (Hymenoptera). W. M. Booker, State University of Iowa. (Introduced by J. H. Bodine.)
62. Quantitative studies on precipitins. Joseph G. Baier, Jr., University of Wisconsin. (Introduced by William H. Cole.)
63. Serological studies of tissue antagonism in the domestic fowl. A. W. Kozelka, University of Chicago. (Introduced by F. R. Lillie.)
64. The ovary of the rat after hypophysectomy. Olive Swezy and Richard I. Pencharz, University of California.
65. Ovogenesis and the hypophysis. Olive Swezy and Herbert M. Evans, University of California.
66. Changes in the skin of normal and gonadectomized 'red phase' Triturus following phyone injections. A. E. Adams, Mount Holyoke College.
67. The effect of injections of human pregnancy urine, and an extract of that urine on the reproductive organs of the immature male rat. Earl O. Butcher, Hamilton College.
68. Effect of blood from pregnant women upon proliferation in the uteri of virgin mice. Reginald G. Harrison, Biological Laboratory, Cold Spring Harbor, New York.
69. The effect of many corpora lutea on germ-cell formation and growth in the ovary of the white rat. Earl O. Butcher, Hamilton College.
70. Corpora lutea and experimental deciduomata in relation to mammary-gland growth and function. Warren O. Nelson, University of Chicago.

71. The reciprocal hypophyseal-ovarian relationship in the control of mammary-gland development and function. Warren O. Nelson, University of Chicago.
72. Implantation of pineal glands in the Leghorn fowl. A. W. Kozelka, University of Chicago. (Introduced by F. R. Lillie.)
73. The problem of hen-feathering in Sebright cocks. L. V. Domm and T. F. Gallagher, University of Chicago.
74. Durable vicarious action upon the development of thyroidectomized albino rats of thyroid from newborn rats implanted into the eye. Raoul M. May, College de France, Paris.
75. Distention of the oviduct in the fowl. L. V. Domm, University of Chicago.
76. Differential distribution of water in the tissue along the long axis of Allolobophora caliginosus. J. William Buchanan and Mary Kopenhaver, Northwestern University.
77. The relationship between water content and oxygen consumption of certain fresh-water organisms. W. R. Duryee, Northwestern University. (Introduced by J. W. Buchanan.)
78. Experimental studies on fusion in Hydra. Emma Johnstone Papenfuss, Johns Hopkins University. (Introduced by H. S. Jennings.)
79. Regeneration in Corymorpha as affected by a thermal gradient. F. G. Gilchrist and L. K. Schmid, Claremont College.
80. Abnormal outgrowths induced in planarians by cautery. E. D. Goldsmith, Harvard University. (Introduced by H. W. Rand.)
81. Antennal regeneration in Daphnia magna. B. G. Anderson, Western Reserve University. (Introduced by the Secretary of the Society.)
82. Regeneration in Phagocata gracilis. J. W. Buchanan, Northwestern University.
83. Regeneration of the lamina propria of anuran tympanic membrane. O. M. Helff, New York University.
84. Rate of regeneration of partly histolyzed anuran tail skin. H. J. Clausen, New York University. (Introduced by O. M. Helff.)
85. Regeneration of hind limbs in the vermilion-spotted newt, Triturus viridescens. H. H. Collins, University of Pittsburgh.
86. The effect of temperature on the scale form of regenerated lizard skin. G. K. Noble and H. T. Bradley, The American Museum of Natural History.
87. Further observations on heteroplastic transplants of duck kidney tissue. Carl J. Sandstrom, New York University. (Introduced by H. W. Stunkard.)
88. Heteroplastic transplantations of duck cartilage to the chorio-allantoic membrane of the chick. Carl J. Sandstrom and George L. Kauer, New York University. (Introduced by H. W. Stunkard.)
89. Skin grafts as indicators of interspecific relationships in urodeles of the genus Triturus. Russell L. Anderson, Johnson C. Smith University and University of Pittsburgh. (Introduced by H. H. Collins.)
90. Some reactions of an amphibian host, Triturus viridescens, against implanted mammalian tissues. Henry Idzkowsky, University of Pittsburgh. (Introduced by H. H. Collins.)
91. Development and regression of dermal plicae following homoplastic and heteroplastic transplantation. O. M. Helff, New York University.

92. Influence of annular tympanic cartilage on tympanic membrane formation following involution. O. M. Helff, New York University.
93. Maintenance of an external nares in the anuran. O. M. Helff, New York University.
94. Potential influences of the quadrate and suprascapula on tympanic-membrane formation in the anuran. O. M. Helff, New York University.
95. The shedding of the horny teeth and mandibles of anuran larvae during metamorphosis. O. M. Helff, New York University.
96. Differences in histolytic incidence of anuran tail integument. F. W. Dunihue, New York University. (Introduced by O. M. Helff.)
97. Anteroposterior cytolytic disintegration in Planaria dorotocephala. J. W. Buchanan, Northwestern University.
98. The toxic effects of copper sulphate and the protective action of colloidal dyes. Arthur Louis Schipper, State University of Iowa. (Introduced by J. H. Bodine.)
99. The relationship between surface activity of homologous carbamates and their effects on E. M. F. and oxygen consumption of frog skin. Edgar John Boell and A. B. Taylor, State University of Iowa. (Introduced by J. H. Bodine.)
100. Stimulation by mineral acids and by the normal aliphatic acids at different hydrogen-ion concentrations in the barnacle. J. B. Allison, William H. Cole, and Irwin Sizer, Rutgers University.
101. Stimulation in the barnacle and the killifish by the dicarboxylic acids. Irwin Sizer, Rutgers University. (Introduced by William H. Cole.)
102. Stimulation by sodium and potassium salts in Balanus balanoides. J. B. Allison and William H. Cole, Rutgers University.
103. Stimulation in Fundulus by hydrochloric and by fatty acids at different hydrogen-ion concentrations in sea water. J. B. Allison and William H. Cole, Rutgers University.
104. Differences in electrical potential between various levels of the tail of anuran larvae. O. M. Helff, New York University.
105. Electroendosmose in Tradescantia epidermis. Gordon Marsh, State University of Iowa. (Introduced by J. H. Bodine.)
106. Relation between current density, time, and response of Amoeba proteus to electricity. William F. Hahnert, Johns Hopkins University. (Introduced by S. O. Mast.)
107. Reactions to electricity in Spirostomum ambiguum. William F. Hahnert, University of Pennsylvania. (Introduced by S. O. Mast.)
108. Relation between locomotion and frequency of contraction of the contractile vacuole in Paramecium caudatum. John A. Frisch, Loyola College and Johns Hopkins University. (Introduced by S. O. Mast.)
109. The influence of the central nervous system on response to light in the earthworm, Eisenia foetida. C. Ladd Prosser, Johns Hopkins University. (Introduced by S. O. Mast.)
110. Conditioned behavior of isolated and grouped cockroaches on a simple maze. Mary Frances Gates and W. C. Allee, University of Chicago.
111. Studies in population physiology. II. Factors regulating initial growth of Tribolium confusum populations. Thomas Park, University of Chicago. (Introduced by W. C. Allee.)

112. Studies in animal aggregations. Further analysis of the protective value of biologically conditioned fresh water for the marine turbellarian, Procerodes. W. C. Allee, Marine Biological Laboratory and University of Chicago.

EMBRYOLOGY

Read

113. Age of human embryos. George L. Streeter, Carnegie Institution of Washington. (Lantern; 12 min.)
114. Embryology of the Skimmer (Rynchops nigra). I. The early developmental stages. Alice L. Brown, Emma Vandergrift, and Mary Rowland Watts, Brenau College. (Introduced by Secretary of Section F.) (Lantern; 10 min.)
115. The reproductive cycles of some cave bats. Mary J. Guthrie, University of Missouri. (10 min.)
116. Culture 'in vitro' and transplantation of young rabbit embryos. A. J. Waterman, Brooklyn College. (Introduced by Leigh Hoadley.) (10 min.)
117. Cytoplasmic localization in the unsegmented egg of the newt, Triturus viridescens, as shown by the development of egg fragments. G. Fankhauser, Princeton University. (Lantern; 7 min.)
118. The role of the chromosomes in the early development of merogonic embryos in Triturus viridescens. G. Fankhauser, Princeton University. (Lantern; 7 min.)
119. The organization and proliferation of nervous tissues in rat embryos developing upon the chick chorio-allantois. J. S. Nicholas and D. Rudnick, Yale University. (Lantern; 15 min.)
120. In vitro ossification of cranial primordia from the rat. Margaret R. Murray, Columbia University. (Lantern; 15 min.)
121. An irradiation method for detecting factors in normal development. P. S. Henshaw, Memorial Hospital, New York City. (Lantern; 15 min.)

Paper no. 128, listed by title below, will be read if time permits.

By demonstration

122. The cortex of the Arbacia egg during segmentation. (Illustrated by motion-picture film.) Robert Chambers and C. G. Grand, New York University.
123. Normal table of the development of the guinea-pig from 11 days to 35 days, copulation age. Mary T. Harman and Marjorie Prickett Dobrovolny, Kansas State College.

By title

124. New experiments on sex in parabiotic twins of Amblystoma maculatum Shaw. Emil Witschi, State University of Iowa.
125. The non-specificity of anuran hypophyses in the induction of ovulation in toads. Irvin A. Wills, Gardner M. Riley, and Esther M. Stubbs, State University of Iowa. (Introduced by E. Witschi.)
126. Control of the sex characters in the English sparrow, Passer domesticus (Linnaeus). Warren N. Keck, University of Iowa. (Introduced by Emil Witschi.)

127. Activity of the peritoneal (germinal) epithelium of the testis of the musk turtle (Sternotherus odoratus L.). Paul L. Risley, State University of Iowa. (Introduced by E. Witschi.)
128. Reconstitution in the nervous system following unilateral reversal of the dorsoventral axis in part of the spinal cord of Amblystoma punctatum. C. Hutchinson, Yale University and The Wistar Institute. (Introduced by R. G. Harrison.) This paper will be read on Wednesday morning, Section B, if time permits.
129. The production of a supernumerary limb in Amblystoma punctatum by the transplantation of a tail-bud from Rana sylvatica. E. D. Goldsmith, Harvard University. (Introduced by Leigh Hoadley.)
130. The effects of x-radiation on the development and regeneration of the early fore limb bud of Amblystoma punctatum. W. O. Puckett, Princeton University. (Introduced by E. G. Butler.)
131. Fragmentation by centrifugal force of the eggs of 4 Neapolitan sea urchins and development of the halves and quarters. Ethel Browne Harvey, Princeton University.
132. Effects of centrifugal force on fertilized eggs of Arbacia punctulata as observed with the microscope centrifuge. Ethel Browne Harvey, Princeton University.
133. The development of bilaterality in an amphibian (Triturus) egg. Francis G. Gilchrist, Pomona College.
134. The mitotic index in the early development of fish embryos. A. Richards, Ray P. Porter, and Babette Leyens Shumaker, University of Oklahoma.
135. The behavior of individual nerve sprouts, sheath cells, and myelin segments during growth and regeneration of the peripheral nerves in living salamanders. Carl Caskey Speidel, University of Virginia.

CYTOLOGY

Read

136. The effects of x-rays on the chromosomes of Circotettix verruculatus (Orthoptera). E. R. Helwig, University of Pennsylvania. (Introduced by the Secretary of the Society.) (10 min.)
137. The history of a specific chromosome in Amblystoma tigrinum during karyokinesis and interkinesis with special reference to the behavior of the nucleolus as a localized portion of a definite chromosome. William H. Dearing, University of Pennsylvania. (Introduced by Philip P. Calvert.) (Lantern; 15 min.)
138. Chromosome numbers and their origin in parthenogenetically developed larvae and frogs of R. pipiens and palustris. C. L. Parmenter, University of Pennsylvania. (Lantern; 15 min.) (Also by demonstration.)
139. The chromosomes of Schizodactylos monstrosus. C. E. McClung, University of Pennsylvania. (Lantern; 15 min.)
140. The migration of leucocytes through the tubal mucosa of the bat. Mary J. Guthrie, University of Missouri. (5 min.)
141. Growth stages in the egg of Bombyx mori. Hope Hibbard, Oberlin College. (Lantern; 10 min.)

142. The origin of asters during maturation, fertilization, and early cleavage in Chaetopterus eggs. Henry J. Fry, New York University. (Lantern; 15 min.)
143. The reticulation reaction of the colored corpuscles of several marine invertebrates to vital dyes. Alden B. Dawson, Harvard University. (Lantern; 10 min.)
144. The transformation of adipose tissue in the guinea-pig testis following experimental tuberculosis. George A. Baitsell, Yale University. (Lantern; 15 min.)
145. Mathematically precise features of epithelial mosaics. Frederic T. Lewis, Harvard Medical School, Boston, Massachusetts. (Introduced by E. L. Mark.) (Lantern; 15 min.)

By demonstration

146. Central body behavior in brain cells of dogfish embryos. Henry J. Fry and C. W. Robertson, New York University.
147. Central body structure in Chaetopterus eggs at metaphase, first cleavage, as demonstrated by various fixatives. Henry J. Fry, New York University.
148. The chromosomes of pigeons and doves. Robert T. Hance, University of Pittsburgh.
149. Intranuclear crystalloids in the superficial epidermal cells of the catfish. Alden B. Dawson, Harvard University.
150. The zone of Golgi in the surface epithelium of the stomach of the Necturus. Alden B. Dawson, Harvard University.
151. Histological changes in the body of Placobdella parasitica associated with hypodermic impregnation. Raymond J. Myers, University of Pennsylvania. (Introduced by J. Percy Moore.)
152. The histophysiology of the amphibian thyroid following experimental release of the stored secretion. Madeleine P. Grant, Smith College. (Introduced by the Secretary of the Society.)
153. The effect of homoplastic anterior-pituitary implants upon the thyroid of Necturus larvae. Madeleine P. Grant, Mary Clapp, and Mary Ruby, Smith College. (Introduced by the Secretary of the Society.)

By title

154. Staining reactions of protoplasm and its formed components: a cytological and biochemical study. Katharine R. Jeffers, Bryn Mawr College and University of Missouri. (Introduced by Mary J. Guthrie.)
155. A study of the 'intracellular structures of Eberth.' Isabelle Weed, State University of Iowa. (Introduced by H. W. Beams.)
156. Cytological studies on the pharyngeal glands of the worker bee, with special reference to the intercellular secretory canaliculi, Golgi bodies, and mitochondria. H. W. Beams and R. L. King, State University of Iowa.
157. The epidermal 'glands' of Ceratodus and Protopterus. Clifford R. Alvey, New York University. (Introduced by H. A. Charipper.)
158. Notes on the cytology of the rat's liver. Edith M. Jay, State University of Iowa. (Introduced by H. W. Beams.)

159. A preliminary report on the histology of the body fluid of Mellita quinquiesperforata (Leske). Ellinor H. Behre, Louisiana State University.
160. Histological changes in the gonads associated with sex reversal in the American oyster (Ostrea virginica). W. R. Coe, Yale University.
161. Cellular changes during the regeneration of small pieces of Planaria agilis. C. Kenneth Collings, University of Missouri. (Introduced by Mary J. Guthrie.)
162. Histological changes in the alimentary tract and pancreas of anuran larvae during involution. R. G. Janes, New York University. (Introduced by O. M. Helff.)
163. The Golgi bodies in the male germ cells and nerve cells of mantids. R. L. King and H. W. Beams, State University of Iowa.
164. Golgi bodies and yolk formation in the egg of the guinea-pig. H. W. Beams and R. L. King, State University of Iowa.
165. Cytoplasmic constituents of the somatic cells of the earthworm. I. In the nephridia. H. S. Fish, Harvard University. (Introduced by Alden B. Dawson.)
166. A comparative study of hemopoietic loci in urodeles. I. Spleen, liver, and epicardium. W. C. Barrett, Jr., Harvard University. (Introduced by Alden B. Dawson.)
167. A comparative study of hemopoietic loci in urodeles. II. Mesonephros, bone-marrow, and skeletogenous septa. W. C. Barrett, Jr., Harvard University. (Introduced by A. B. Dawson.)
168. Individuality of the red blood cells in inbred strains of fowls. A. W. Kozelka, University of Chicago. (Introduced by F. R. Lillie.)
169. The culture of mitochondria. C. T. Hurst and J. C. Strong, Jr., Western State College of Colorado. (Introduced by the Secretary of the Society.)

PROTOZOÖLOGY

Read

170. Inheritance of the notched form of Chilodon uncinatus, a mutation produced by the use of ultraviolet rays. Mary S. MacDougall, Agnes Scott College. (Lantern; 10 min.)
171. Nuclear structure, mitosis, and chromosome individuality in an opalinid (protozoa, ciliata). H. T. Chen, University of Pennsylvania. (Introduced by D. H. Wenrich.) (Lantern; 15 min.) (Also by demonstration.)
172. A genetic study of the reduction division in Paramecium aurelia. Daniel Raffel, Yale University. (Introduced by W. R. Coe.) (Lantern; 10 min.)
173. Observations on the morphology and division of a monad flagellate, with a discussion of the genus Monas. Bruce D. Reynolds, University of Virginia. (10 min.)

By demonstration

174. The relation between the form of the living cell and the nuclear phases of division in Amoeba proteus (Leidy). H. W. Chalkley and George E. Daniel, National Institute of Health.

By title

175. A method for culturing Bursaria truncatella. Amos Benkov Kuan-Chim Penn, Johns Hopkins University. (Introduced by S. O. Mast.)
176. Strength of culture medium as a factor in fission rate of Paramecium caudatum. George A. Smith, Brown University and Carnegie Institution of Washington. (Introduced by A. M. Banta.)
177. Some salt marsh ciliates in California. Harold Kirby, Jr., University of California.
178. Observations on the feeding habits of Lesquereusia spiralis, Difflugia oblonga, and Difflugia constricta. A. B. Stump, University of Virginia. (Introduced by B. D. Reynolds.)
179. The method of ingestion in Peranema trichophorum. R. P. Hall, New York University.
180. Synthesis of protoplasm from inorganic compounds in the colorless animal, Chilomonas paramecium. S. O. Mast and D. M. Pace, Johns Hopkins University.
181. Relation of pH of the medium to growth of Euglena deses and E. anabaena var. minor in light and darkness. R. P. Hall, New York University.
182. Relation of hydrogen-ion concentration to growth of Chilomonas. J. B. Loefer, New York University. (Introduced by R. P. Hall.)
183. Effects of certain carbohydrates on growth of Euglena anabaena var. minor in darkness. R. P. Hall, New York University.
184. Effects of certain amino acids on growth of Chlorogonium and Chilomonas. J. B. Loefer, New York University. (Introduced by R. P. Hall.)
185. Species differences in growth characteristics of Chlorogonium. J. B. Loefer, New York University. (Introduced by R. P. Hall.)
186. Effects of population density on the rate of reproduction in Oxytricha. Willis H. Johnson, Wabash College. (Introduced by W. C. Allee.)
187. Strcuture and function of the so-called 'Glanzkörper,' 'nutritive spheres,' 'Golgi bodies,' or 'spherical bodies' in Amoeba proteus. S. O. Mast and W. L. Doyle, Johns Hopkins University.
188. Reappropriation of cytoplasmic fragments. I. In different concentrations of hydrogen ions, and, II. Under the influence of an electric current. E. D. Miller, University of Virginia. (Introduced by B. D. Reynolds.)
189. An investigation of the question of cytoplasmic fusion in Amoeba proteus. Katherine S. Brehme, University of Virginia. (Introduced by B. D. Reynolds.)
190. The vacuome and so-called 'canalicular system' of Colpidium. R. P. Hall and C. H. Alvey, New York University.
191. Reorganization of the axostyle in polymastigote flagellates. Harold Kirby, Jr., University of California.

ANATOMY

Read

192. Morphological changes in the mucous membrane covering edentulous areas of the alveolar process in the human mouth. W. H. Wright, University of Pittsburgh. (Introduced by H. H. Collins.) (Lantern; 8 min.) (Also by demonstration.)
193. The blood of the duck. Thos. B. Magath and Geo. M. Higgins, Mayo Clinic and Mayo Foundation, Rochester, Minnesota. (Lantern; 12 min.)
194. Germ-cell cycles in the amphibian, Triturus viridescens. Helen Marie Hilsman, University of Pittsburgh. (Introduced by H. H. Collins.) (Lantern; 7 min.) (Also by demonstration.)

By title

195. Structure of the hair of the sei whale (Balaenoptera borealis). Leon Augustus Hausman, Rutgers University.

PARASITOLOGY

Read

196. Notes on the genus Isospora (Coccidia) in captive birds. Donald C. Boughton, Johns Hopkins University. (Introduced by Robert Hegner.) (Lantern; 10 min.)
197. Studies on the trematode genus Clinostomum. I. The yellow grub of fish and frogs. George W. Hunter, III, Wesleyan University. (Lantern; 10 min.)

By title

198. The lymph system of Zygocotyle lunatum with a note on the subfamily Zygocotylinae. Charles H. Willey, New York University.
199. The filariid parasites (nematoda) of amphibia. A. C. Walton, Knox College.

ECOLOGY

Read

200. A consideration of the faunal areas of southern Arizona based on the distribution of amphibians and reptiles. Howard K. Gloyd, University of Michigan. (Introduced by the Secretary of the Society.) (Lantern; 15 min.)
201. Life of West Virginia caves. Albert M. Reese, West Virginia University. (Lantern; 5 min.)
202. A method of marking living snakes for future recognition, with a discussion of some problems and results. Frank N. Blanchard, University of Michigan, and Ethel B. Finster, Asheville Normal School. (Lantern; 15 min.)
203. The role of copper in the setting and distribution of the oyster. Herbert F. Prytherch, U. S. Bureau of Fisheries. (Lantern; 15 min.)

By demonstration

204. Apparatus used in the study of spawning and of larval distribution of oysters. T. C. Nelson, Rutgers University.

By title

205. A study of the vertical distribution of Euglena. R. P. Cowles, Johns Hopkins University.
206. On the taxonomic status, range, and natural history of Schott's whipsnake, Masticophis schotti schotti (Baird and Girard). Howard K. Gloyd and Roger Conant, University of Michigan and Toledo Zoölogical Society. (Introduced by Frank N. Blanchard.)
207. Notes on the seasonal movements of some cave bats. Mary J. Guthrie, University of Missouri.

MISCELLANEOUS AND LATE PAPERS

Read

208. A comparison of the life histories of the two kinds of females in the rotifer, Hydatina senta. Josephine Carolyn Ferris, University of Nebraska. (Introduced by D. D. Whitney.) (Lantern; 10 min.)
209. New mutations in Drosophila obscura, race B. Catherine V. Beers, University of Southern California. (Introduced by the Secretary of Section F.) 15 min.)
210. Unique reproductive features in the killifishes of the Mexican plateau. C. L. Turner, Northwestern University. (Introduced by the Secretary of the Society.) (Lantern; 15 min.) (Also by demonstration.)

By demonstration

211. The technic of handling zebra fish (Brachydanio rerio) for the production of eggs which are unusually favorable for embryological and physiological research and are available at any specified time throughout the year. Charles W. Creaser, College of the City of Detroit.
212. The law of evolution and its relation to other laws of kinetic systems. W. H. Longley, Goucher College.
213. The effects of certain hormones on the ovaries of armadilloes in the free-vesicle stage. G. W. D. Hamlett, Indiana University.

ABSTRACTS

An author index for all abstracts will be found on pages 116–120.

COMPARATIVE AND GENERAL PHYSIOLOGY

Read

1. LABORATORY CULTURE OF THE DRONE FLY, ERISTALIS TENAX. William L. Dolley, Jr., C. C. Hassett, and W. J. Bowen, University of Buffalo. (Lantern; 5 min.)

Eristalis tenax has been shown to be especially valuable for the study of its reactions to light, because it is uniformly positive and orients accurately in light, is of large size, and is hardy in captivity. It is also valuable for many other types of work. Previously, attempts to rear it have proved unsuccessful. This organism has now been successfully reared for over 12 months. In December, 1931, a female collected in the open the previous month laid eggs, and from these a strain has been reared continuously since.

The flies are kept in wire cages, 15 × 15 × 15 cm., containing watch glasses filled with tap water. In these cages are also small wooden feeding troughs filled with a mixture consisting of equal parts of dry poppy, Eschscholtzia californica, pollen, and powdered cane sugar. On this food the flies live perfectly and lay many fertile eggs. The larvae are cultivated best on human feces, although they will live on hog manure.

At a temperature of between 20° and 25°C. a typical female began laying eggs 10 days after emergence and laid about 3000 eggs in about 60 days. The eggs hatch in about 36 hours after they are laid. The duration of the larval and pupal stages is about 2 weeks and 8 days, respectively, at about 22°C.

Since the California poppy is easy to raise in large quantities and since its pollen is easy to collect, Eristalis is now available for work throughout the year.

2. MECHANISMS OF HEAT RESISTANCE IN A PIGMENT-BEARING INSECT. Nellie M. Payne, University of Pennsylvania. (Introduced by H. B. Baker.) (Lantern; 15 min.)

In Microbracon hebetor Say, a parasitic wasp (Hymenoptera: Braconidae), death at high temperatures appears to be due essentially to a sudden water loss in the tissues. Heat-resistant strains are better able to retain tissue water than are non-resistant strains.

Light individuals of the same genetic strain are more resistant to high external temperature than are dark individuals of the same strain. However, this resistance to high temperature is more apparent than real, since their internal temperature is lower. At a given internal temperature the light-colored individuals lose their tissue water as readily as do the dark-colored forms. Loss of pigment at high temperatures may in itself be considered an adaptation to

high temperature. Since oxidation rate determines the degree of pigmentation, it is not necessary to consider that pigment loss is an adaptation in the teleological sense. Insects which have an oxidation rate great enough will oxidize certain pigments with resultant loss of color and therefore greater heat resistance due to purely physical factors.

3. The growth of the mussel, Mytilus edulis, at Woods Hole, Massachuetts. Oscar W. Richards, Yale University. (Lantern; 12 min.)

During the last 2 years marked mussels have been grown in a live box under the Bureau of Fisheries wharf and the growth of the animals was measured at intervals of from 2 weeks to one month. The rate of growth increases in late February or early March as plankton food becomes available, even though the water temperature is about 3°C. In summer the growth is retarded during the spawning period, and then a second period of increased growth occurs in the fall. The changes in the water temperature are very constant from year to year. The shape of the animal is quite constant as the animal becomes larger. Growth curves will be presented to analyze the growth of the animals of various ages. This is the first report of the investigation, which will be continued.

4. The effect of temperature and the acetate radical on growth of Euglena gracilis. Theo. L. Jahn, Yale University. (Introduced by L. L. Woodruff.) (Lantern; 10 min.)

Euglena gracilis, grown in the dark, in a medium of hydrolyzed casein and inorganic salts, shows an optimal division rate at 10°C. The average division rate per day at this temperature is about 0.031 as compared to 0.016–0.020 at temperatures of 15 to 30°C. Loss of motility and encystment occurs above 15°C. When sodium or ammonium acetate (3 gm./liter) is added to the above medium, growth is greatly increased, and the optimal temperature is 23°C., instead of 10°C. The increase in the maximal division rate upon the addition of sodium acetate is from 0.031 to 0.47, an increase of about 15 times. Comparisons of division rates at 23°C. show an increase of over 28 times (0.0165 compared to 0.47) in the acetate cultures. At this temperature encystment or loss of motility occurs only in old cultures. The pH of the non-acetate cultures in all cases was 6.7 $\pm$ 0.1 at the beginning and end of the experiments. However, the Na-acetate cultures became more alkaline (even to 7.8 in cultures showing the greatest growth), probably due to the utilization of the acetate radical by the organism.

The optimal amount of ammonium acetate is different in the light (M/1280) and dark (M/160), and at these optima the relative acceleration of division rate (above non-acetate controls) in the light is only 33 per cent instead of 1000 per cent as in the dark at 26°C. The optimal concentration of Na-acetate is higher than that for ammonium on account of the higher toxicity of the ammonium compound.

5. The effect of alternating temperatures on the pupal development of Drosophila melanogaster. Daniel Ludwig and Raymond M. Cable, New York University. (Lantern; 15 min.)

The rate of pupal development of Drosophila was studied at constant and alternating temperatures (exposed for 24 hours at each temperature). When one of the two alternating temperatures was near the physiological zero (the point at which the rate curve crosses the temperature axis), the rate was accelerated as compared with that at the mean constant temperature. At 10° alternating with 20°, the pupal stage in the female required 256 hours, as compared with 331 hours at 15° and 154.8 hours at 20°C. At 10°, which is below the theoretical threshold, no adults emerged, but they appeared to be completely formed within the puparium in about 40 days. At 5° alternating with 27°, it required 172 hours, exactly twice 86 hours, the time required at 27°. Development occurring below the theoretical threshold accounts for the acceleration just described.

When one of the temperatures is above the optimum (29°), development is retarded. At 26° alternating with 31°, the pupal stage in the female required 84 hours as compared with 78.5 hours at 28.5°; at 24° and 33°, exposed to 24° first, it required 93 hours. Development at constant temperatures above the optimum is sufficiently retarded to account for these results. At 24° and 33°, exposed to 33° first, the pupal stage in the female required 100 hours. Experiments have shown that this greater retardation is due to a greater susceptibility to unfavorable temperatures during the first 24 hours of pupal life.

6 New data with possible bearings upon Robertson's theory of allelocatalysis. Maurita McPherson, George A. Smith, and A. M. Banta, Brown University and Carnegie Institution. (Lantern; 15 min.)

Animals have been reared singly and in groups in identical restricted environments—a cladoceran (Moina macrocopa) in 50 cc. volumes, 1) of manure solution and, 2) in bacterized medium, and Paramecium caudatum in drop cultures of oat-straw culture medium. The production of the first clutch of parthenogenetic young by Moina marks the attainment of a definite stage of development; just as rate of fission marks the progress of a culture of Paramecium.

When sister Moina were reared 1, 3, 6, and 9 per bottle in concentrated culture medium the 9 mothers produced their first offspring before the 6, the 6 before the 3, and the 3 before the 1. In less concentrated or in dilute medium, on the other hand, the order of production of young is reversed, the single mothers release young first, followed in order by the 3-, the 6-, and the 9-mother groups.

With Paramecium caudatum groups of animals (drop cultures of oat-straw infusion) have a higher fission rate in every strong medium than singles; in weak medium the reverse is true.

The results with both animals in the strong medium resemble results interpreted as allelocatalysis by Robertson and his supporters; and in the weak medium resemble results obtained by those whose interpretations are opposed to Robertson's interpretation. It seems possible that conflicting results in this field of study may have arisen, in part at least, from differences in strength (food value) of culture medium used by different workers.

7. Sex ratio in the domestic fowl. T. C. Byerly, E. McNally, and M. A. Jull, U. S. Department of Agriculture. (Lantern; 15 min.)

The average percentage of males in 2414 progenies from the flocks at the United States Animal Husbandry Experiment Farm, consisting of 28,015 individuals, was found to be 50.14. The birds were sexed at 10 weeks of age. Statistical analysis of the data failed to reveal any significant correlation between embryo mortality and sex ratio or between chick mortality and sex ratio.

The sex of 5807 dead embryos was determined; of these, 46.6 per cent were males. Data on carbon-dioxide production of the chick embryo, so far collected, fail to support the hypothesis that the male embryo has a higher metabolic rate than the female.

8. Further studies on the longevity and swimming ability of spermatozoa. B. H. Grave, De Pauw University. (Lantern; 10 min.)

In a reinvestigation of the swimming ability of the spermatozoa of Arbacia and Cumingia it was learned that they swim approximately 20 cm. Some lots of sperm of each species will swim farther than others of the same species. In all cases the rate of swimming slows down after 2½ hours and little progress is made after the lapse of that period of time. Spermatozoa are more or less active for 10 hours and the rate is about as follows: Seven centimeters are traversed in 40 to 50 minutes; 9 cm. in one hour; 12 cm. in 1¼ to 1½ hours; 15 cm. in 1½ to 2½ hours; 16 cm. in 2½ to 5 hours; and 18 cm. in 5¼ to 9 hours.

9. Effect of acetylsalicylic acid on germ cells and early developmental stages of Arbacia. Robert A. Budington, Oberlin College. (Lantern; 10 min.)

As first pointed out in detail by Cohn, acidity tends to inactivate sperm, but for that reason prolongs their actual vitality. Arbacia sperm in sea water to which acetylsalicylic acid has been added shows the above effect in degrees proportionate to acidity strength. Sperm in a solution of pH 6.77 may be inactive as long as 72 hours, at 21°C., and yet recover and fertilize eggs whcih then develop normally.

Eggs placed in a series of solutions of graded strengths show distortions of normal development in direct proportion to strength of solution. Development in solutions of pH 6.77 results in much irregularity of cell division, and retardation. Practically no development occurs in solutions of a pH of 6.3. Whether or not cleavage will occur in the stronger solutions depends on how long after fertilizations the eggs are transferred to them.

10. The effect of nursing upon the glutathione concentration of newly born rabbits. Harold Goss and P. W. Gregory, University of California. (Introduced by the Secretary of the Society.) (Lantern; 10 min.)

In a previous contribution we have shown that glutathione concentration of non nursed, fasted newly born rabbits from races differing in adult body size is related to the rate of segmentation of the egg, of birth weight related to adult size, and adult body weight. The present investigation was made in a race

of New Zealand Red rabbits which bred true for an adult body weight of approximately 3600 grams, and thus the effect of genetic constitution on glutathione concentration was eliminated. Pregnant does at the time of parturition were placed in a special maternity cage so that none of the litter could nurse. The litter was then recorded, weighed and ear marked so as to preserve the identity of each. The litter was then divided—one half was returned to the mother for 48 hours in order that they might nurse, and the other half of the litter was fasted for 48 hours. At the end of the 48-hour period the total glutathione concentration of each animal was determined. The glutathione concentration for 18 non-nursed, fasted animals ranged from 19 to 47 mg. per 100 grams of body weight with a mean concentration of 33.94 ± 2.53. The glutathione concentration of the 20 nursed litter mates ranged from 43 to 77 mg. per 100 grams of body weight with a mean concentration of 64.6 ± 3.48.

As a tentative explanation for this effect of nutrition, we suggest that with the factor of genetic composition eliminated, the glutathione concentration of newly born rabbits is also related to the intensity of metabolic processes in connection with an increase in cell proliferation.

11. Some pharmacological reactions of Arctomys monax. David I. Macht, Hynson, Westcott and Dunning, Inc. (Introduced by the Secretary of the Society.) (15 min.)

It is well known to pharmacologists that different genera, and even different species, of animals may react in a different way to identical pharmacological agents or drugs and chemicals. For this reason, an opportunity presenting itself, it was deemed interesting to study the reactions of Arctomys monax, or a woodchuck, to various drugs. Special studies were made on circulation, respiration, blood, and reaction of smooth-muscle organs to a number of important pharmacological agents. The drugs employed were ether, epinephrin, amyl nitrite, pilocarpin, physostigmin, atropin, mono-brom saligenin, and others. In general, the woodchuck exhibited the same qualitative reactions to these agents as those produced in the rabbit and the cat, but quantitative differences were noted. The effects produced on Arctomys monax by the different chemicals employed will be described in detail.

12. Prolactin, a new and third hormone of the anterior pituitary. Oscar Riddle, Robert W. Bates, and Simon W. Dykshorn, Carnegie Institution. (Lantern; 15 min.)

An acid- and alkali-soluble, iso-electric insoluble, fraction of the anterior pituitary of cattle and sheep has been prepared, made free of gonad-stimulating and (probably of) growth principles. The dry substance resists heating for one hour at 100°C.; in solutions (pH 1.0–11.0) it is rapidly destroyed, being more stable at pH 2.0–3.0.

Prolactin has been definitely identified as the principle which stimulates the development and functioning (crop-milk formation) of the crop-glands of pigeons and the active secretion of milk in mammals. This hormone does not seem, even in slight degree, to favor mammary growth, but specifically stimulates the prepared gland to milk secretion. Neither the growth hormone, the gonad-stimulating,

nor the luteinizing hormone from pregnant urine is capable of inducing either the crop-gland or milk-secretion response. Combinations of growth and gonad-stimulating hormones also fail to elicit either of the 2 specific responses of prolactin.

Immature male guinea-pigs, both castrate and normal (after previous mammary development by theelin and progestin administration), have been made to secrete milk beginning on the fourth or fifth day following injection of prolactin. Mature female guinea-pigs, both castrate and normal, begin secretion from the second to fifth day following injection of prolactin. Mature female rabbits, both castrate and normal, begin secretion of milk on the second to sixth day following the subcutaneous or intramuscular injection of prolactin. In both guinea-pigs and rabbits a single large dose is effective.

13. Leg weakness induced by antuitrin, and the regulation of calcium metabolism by iodine. F. E. Chidester, A. L. Ashworth, G. A. Ashworth, and I. A. Wiles, West Virginia University. (10 min.)

Intravenous injections of antuitrin were apparently the cause of leg weakness in 7 young chicks. Fourteen thyroid-fed chicks on the same diet, but without antuitrin injections, did not develop leg weakness. Since the studies of Malcolm and Franchini have indicated that the pituitary hormone may exert a catabolic effect on bone, and injected pituitary hormone may cause a decrease in calcium content of the blood, it seems probable that our cases of leg weakness were caused by the pituitary injections.

Loeb, Schockaert, and Loeser have independently shown that injections of antuitrin result in a decrease in the iodin content of the thyroid glands in mammals and birds.

These facts would seem to be important in explaining the results obtained by Mr. Brinton, a poultry man, who reported to us that he was able to cure and to prevent leg weakness in fowls by feeding iodized buttermilk.

We believe that the iodin content of cod-liver oil may be in part responsible for its recognized superiority to ergosterol in some cases of rickets.

14. The preparation of oestrin-free progestin from corpora lutea of swine. Willard M. Allen and Roland K. Meyer, University of Rochester. (Lantern; 15 min.)

Corpus-luteum extracts when prepared by either the acid-alcohol method or the boiling-alcohol method contain both oestrin and progestin. This makes it impossible to state accurately whether a physiological response produced by such an extract is due to either of the 2 hormones acting separately or to both. During the process of purifying these extracts in this laboratory it was found that progestin could be completely extracted from a dilute alcoholic solution with petroleum ether. This observation immediately made a separation theoretically possible, because Doisy has already demonstrated that oestrin is much more soluble in dilute alcohol than petroleum ether. We have found by actual test that extraction of a 33 per cent alcoholic solution containing both hormones with petroleum ether produces an excellent separation of the 2 hormones, the progestin being found in the petroleum ether and the oestrin in the alcohol. We

have also found that a petroleum-ether solution of the 2 hormones can be freed of its oestrin by washing with 0.5 normal alkali and that this procedure is accompanied by a 40 per cent loss of the progestin. These data show that oestrin can be separated from progestin and also that these closely related hormones have chemical as well as physiological differences. The oestrin was assayed by the mucification test, since we have shown that mucification of the vagina of the castrated mouse may be produced by theelin. The progestin was assayed by the progestational proliferation test in castrated adult rabbits.

15. THE PRECOCIOUS DEVELOPMENT OF SEXUAL CHARACTERS IN THE FOWL BY DAILY INJECTIONS OF HEBIN. I. THE MALE. L. V. Domm and H. B. Van Dyke, University of Chicago. (Lantern; 7 min.)

Brown Leghorn cockerels, ranging from 21 to 47 days in age, received daily subcutaneous injections of hebin. The quantities administered ranged from 4 to 32 rat units in single daily injections. The duration of the experiments varied from 14 to 36 days.

The first effect noticed was a pronounced stimulation of head furnishings. This could be definitely noted, in some instances, as early as 48 hours after injections began. The comb revealed steady growth throughout and, at the conclusion of experiments, was usually considerably larger than controls. Precocious sexual behavior was noted in some of the older individuals treated. No plumage modifications were evident.

Postmortem revealed hypertrophy of testes. These were usually larger and heavier than controls. Thyroids were likewise larger and heavier in treated birds. The spleen, liver, and heart did not seem to show significant changes in weight, though experimental spleens were fairly consistently somewhat lighter than controls.

Histological examination of testes revealed significant modifications. In the cases studied tubules of control testes were distinctly juvenile, still showing primordial germ cells, whereas those in treated testes revealed spermatogenesis. Thyroids from treated individuals revealed larger tubules and more colloid. No significant changes could be detected in sections of ductus deferens.

The effects were roughly proportional to concentrations administered. The results in general confirm earlier observations of Domm ('31) on precocious development of sexual characters in Leghorn cockerels following daily subcutaneous homeoplastic hypophyseal implants. Preliminary experiments on capons revealed no response in head furnishings or behavior, though they revealed a pronounced hypertrophy of thyroids.

16. THE PRECOCIOUS DEVELOPMENT OF SEXUAL CHARACTERS IN THE FOWL BY DAILY INJECTIONS OF HEBIN. II. THE FEMALE. L. V. Domm and H. B. Van Dyke, University of Chicago. (Lantern; 8 min.)

In a second series of experiments brown Leghorn females received daily subcutaneous injections of hebin. Concentrations injected, age range, and duration of experiments were identical with the experiments on cockerels.

Here also the first effect noticed was a striking growth of head furnishings. This was definitely noticeable within 48 hours in individuals receiving higher

concentrations. In such experiments head furnishings revealed a continuous high growth rate throughout, becoming masculine in character. The comb became stout of blade and erect, whereas that of similar size in normals, only found in much older females, shows a thin loppy blade. Plumage and behavior were apparently unaffected.

Postmortem revealed considerable hypertrophy of ovaries. These were larger and heavier than controls, but showed no indications of ovulation. The surface of more advanced ovaries had a mulberry appearance, indicating follicular development. The more advanced oviducts showed astonishing hypertrophy comparable to that normally preceding ovulation. The weight of these exceeded 15 times that of controls. Thyroids were larger and heavier than controls. Differences in weights of liver, spleen, and heart were probably not significant though experimental spleens were usually heavier.

Histologically, experimental ovaries showed larger follicles. Sections of normal oviducts showed low mucous folds devoid of tubular glands and conspicuous muscle layer, whereas experimentals showed high mucous folds, well-developed tubular glands, and conspicuous peripheral muscle layer. Experimental thyroids showed larger tubules and more abundant colloid.

Effects were in general proportional to concentrations injected. The results confirm the earlier experiments of Domm ('31) following daily hypophyseal implants on juvenile females.

17. Pineal implants in rats. G. E. Johnson and E. L. Lahr, Kansas State College. (Lantern; 10 min.)

Pineal bodies from mature rats were daily implanted subcutaneously into 24 young albino rats. For each of these there was a litter-mate control which received a daily implant of brain tissue. Implantation periods varied from 16 to 41 days.

The daily weight records of these 48 rats showed no influence of the pineal glands on the body growth of either sex. The pineal implanted rats in nearly all cases showed a retardation of sexual maturity. The pineal implanted males had smaller testes, less advanced spermatogenesis, and smaller tubules at autopsy under 60 days of age, and they became scrotal later than the controls. The pineal implanted females had smaller ovaries, and the vagina opened later than in the controls.

18. Activity of the heart and movement of blood in the transparent larva of Ammocoetes. J. Frank Daniel, University of California. (Charts; 10 min.)

In an early larva, 2½ to 3 mm. in length, the heart beats faintly and at a slow rate. At 5 mm. the rate increases to about 60 beats per minute, and the circulating mass is colorless. At 6½ mm. color obtains.

Heart beat at 10 mm. may be resolved into 5 events or moments. Event one begins with the auricular diastole. The sinu-auricular constriction opens, the valves float out into the auricular chamber, and the blood enters and passes through the auricle in 3 channels. At the second moment auricular blood comes almost to a standstill. At the third, the auriculoventricular valves open, and

during this and the fourth moments blood streams into the ventricle at the same time that it is entering from the sinus venosus. During both of these periods the auricle serves passively as a passageway. The fifth event involves systole. The wave of contraction which has started near the mouth of the inferior jugular vein passes over the sinus venosus, the sinu-auricular valves close suddenly, and the auricular walls are thrown into a rocking motion as the column of blood is shunted into the ventricle. The auriculoventricular valves then close sharply, and the ventricular contraction hurls the blood forward and out through the conus arteriosus.

19. Studies on the physical chemistry of fish hemoglobin. R. W. Root College of the City of New York. (Introduced by A. C. Redfield.) (Lantern; 15 min.)

The bloods of the toadfish, Opsanus tau (Linnaeus), the goosefish, Lophius piscatorius Linnaeus, and the tautog, Tautoga onitis (Linnaeus), were investigated from the standpoint of the effect of hydrogen-ion concentration on the form and position of the oxygen-dissociation curves, and on the capacity of the hemoglobin to combine with oxygen. This effect was studied over a wide range of pH and gas tensions. It was found that acid, either carbon dioxide or lactic, not only brings about a profound change in the value of the dissociation constant, but that it also prevents a certain part of the hemoglobin from combining with oxygen at all. In sufficiently acid medium the oxygen capacity of the bloods, even in oxygen (methemoglobin is ruled out), is reduced almost 75 per cent. The oxygen-dissociation curves show the following unique features: 1) very marked change in dissociation constant with change in pH, and failure, in increasing acidity, to ever approach the original 100 per cent saturation point; 2) goosefish blood yields simple rectangular hyperbolae on the acid side, but changes to second-power curves on the alkaline side of neutrality; 3) toadfish blood yields curves of double inflections, instead of the ordinary form of curves, these curves apparently being made up of first- and second-power components which have widely different values for their dissociation constants; and, 4) tautog blood yields curves more or less intermediate in type between the other two. An interpretation is offered for the data that have been obtained.

20. Heteroplastic transplantations of macerated duck-kidney tissue to the chorio-allantoic membrane of the chick. Carl J. Sandstrom and Joseph T. Kauer, New York University. (Introduced by H. W. Stunkard.) (15 min.)

Heteroplastic transplants of macerated duck-kidney tissue were made to the chorio-allantoic membrane of the chick. The donor tissue obtained from 13-, 21-, and 27-day duck embryos was ground in a mortar just previous to transplantation. It consisted of individual and small groups of cells and isolated bits of tubules. Many of the cells were injured. The transplants were made to 9-day chick embryos and removed at 48-hour intervals during a period of 9 days' incubation.

The grafts resulting from 13-day donors removed before the eighth day showed evidence of a reorganization into apparently normal tissue. They contained long collecting and secreting tubules, and numerous glomeruli, but the rela-

tions of these parts have not as yet been worked out. Beginning with the eighth day on the host, tissue removed showed localized necrosis, granulocytic invasion, and an increase in amount of connective tissue within the graft.

The reorganization of tubules in the tissue from the 21- and 27-day donors was of a very low order. Normal tubules were the exception, and the majority of the tissue in the grafts was unorganized and necrotic. Granulocytic invasion was marked in all the grafts of these series, and an increase was noticed in the amount of connective tissue invading the grafts. In none of the grafts of any series was a lymphocytic invasion noted.

21. Xenoplastic inductions. Oscar Schotté, Yale University. (Introduced by R. G. Harrison.) (Lantern; 15 min.) (Also by demonstration.)

Xenoplastic transplantations in early stages between urodele and anuran embryos were performed first in collaboration with H. Spemann (Freiburg, Germany) and continued here last spring. Various series of operations showed following results.

The transplantation of upper blastoporal region (organizer) from urodele to anuran gastrula and vice versa produced inductions of secondary embryos with a complete set of organs. Furthermore, in both anuran and urodele embryos, presumptive abdominal ectoderm from gastrulae was observed to be transformed, if transplanted in the corresponding region, into xenoplastically induced lenses, ear vesicles, nasal placodes, and pituitary glands.

Presumptive abdominal skin from anuran gastrulae placed in the lower face region of a late urodele gastrula or neurula develops into organs which proved to be suckers morphologically, histologically, and functionally. Transplanted in the upper head region of a urodele embryo, this same material develops into a vesicle recognizable as an operculum. The same material transferred in the presumptive mouth region of a urodele is transformed there into typical tadpole mouth organs: lips with horny teeth and papillae, a beak with upper and lower jaw covered with histologically perfect horny teeth.

As there is some evidence that no specific inductors are present in the urodele for such foreign organs as suckers, operculums, and horny teeth, one must admit that induction consists merely in transformation of undetermined material into regions corresponding to their new position, while it is left to the inherent potencies of the transplanted material to develop organs which belong to these regions.

22. A reinvestigation of data on regeneration in the carapace of Daphnia magna. B. G. Anderson, Western Reserve University. (Introduced by the Secretary of the Society. (Lantern; 10 min.)

A reinvestigation of data on regeneration in the carapace in Daphnia magna has shown that the relation between the amount of regeneration during any adult instar is a parabolic function of the area of the wound during that instar. This relation may be expressed by the equation $x = ay^k + y$, where x is the area of the wound; y the amount of regeneration; and a and k, constants.

It has been found that the amount of regeneration during any adult instar decreases with the age of the animal and with the age of the wound. The decrease is greater in the latter case. Temperature appears to have little or no influence.

23. Resorption in the ductuli efferentes of the mouse and its significance for the genital-tract-ligature problem. William C. Young, Brown University and Anatomical Institute, Freiburg, i. Br. (Lantern; 15 min.)

Following separation of the ductuli efferentes from the testis on one side, mice were injected subcutaneously with 10 per cent acid-fuchsin or 1 per cent trypan-blue solutions. Later, when fresh and fixed preparations of the ductuli efferentes and ductus epididymidis were studied, dye-particle deposition was found practically limited to cells of the ductuli efferentes and to be much stronger in cells on the unoperated than on the operated side. This and other evidence indicated below is thought to confirm von Möllendorff's suggestion that the ductuli efferentes are resorptive.

The resorbed fluid is one which appears to pass from the blood stream into the seminiferous tubules and thence into the ductuli efferentes where much of it is reconveyed to the blood.

When passage of this fluid from the testis is prevented by occlusion of the ductuli efferentes, it accumulates in the seminiferous tubules and causes a disappearance of the germinal epithelium. Less pronounced changes occur 15 days after ligature of the caput epididymidis, but ligature of distal levels is without any effect within 4 months after the operation, presumably because there is no interference with normal resorptive activity in the ductuli efferentes.

The structure of testes, the ductuli efferentes of which have been occluded, is easily distinguishable from that of testes injured by other means. For this reason, the changes are regarded as being a specific consequence of this operation and are not to be confused with the effect referred to in Moore's well-founded criticism of earlier genital-tract-ligature studies.

24. Catalase and oxidative processes in animal tissues as possible factors in adaptation. Hoyt S. Hopkins, New York University. (Lantern; 10 min.) (Also by demonstration.)

From a comparative study of the species of lamellibranchs on the North Carolina coast and of another series in Bermuda, it is concluded that the ability to live above low-tide level or exposed to somewhat anoxybiontic conditions (as in marshes), is directly related to the amount of catalase determined in the muscles; and that, in species limited to life in deeper water or along wave-washed shores, the amount of catalase is small. The tissue oxidation rate is low in the tropical (Bermuda) species, and nearly the same in all. In these (5 varieties) a direct picture of the vertical distribution is afforded by the figures for catalase—ranging from 9 in one species, which lives submerged, usually in deep water, to 44 in another, which inhabits the intertidal zone. For the Carolina species (12), average figures for those at the extremes of 8 and 93 are obtained. The oxidation rates are diverse, however; and, in almost every case, these are higher than in the tropical forms. The general activity of the species is not correlated with the intensity of muscle metabolism as measured. In those species inhabiting a similar environment, e.g., a sandy shoal, the rate of oxidation and the abundance of catalase in the muscles are usually proportional. Hence the ratio, oxidation: catalase, better serves to characterize the habitat or distribution of a species.

25. The effect of hypertonic solutions on the oxygen consumption of a developing egg (Orthoptera). J. H. Bodine, State University of Iowa. (Lantern; 10 min.)

The chitinous cuticle of the egg of the grasshopper, Melanoplus differentialis, is markedly semipermeable in nature. Changes in the water content of eggs have been experimentally produced by exposures to hypertonic Ringer solutions. Rates of oxygen consumption of eggs thus dehydrated have been determined. In general, it has been found that subjecting eggs to hypertonic solutions results in marked decreases in their rates of oxygen consumption. The decrease is roughly proportional to the osmotic pressures of the solutions employed. Reversible decreases of from 60 to 70 per cent of the normal rates have been found.

26. Influences of the nervous system and of respiration upon urine formation in the frog. Edward F. Adolph, University of Rochester. (Lantern; 10 min.)

It was previously found that when frogs were pithed, the body weights while in water at 27°C. increased faster than the weights of normal frogs whose urine was retained. Frogs that were prevented from urinating by tying their cloacae proved to form no urine after pithing. But pithed frogs formed urine at normal rates if kept at 9°C., a temperature at which oxygen was adequately supplied to the blood through the skin. At intermediate temperatures some urine formed, providing the breathing was not interrupted. Urine formation evidently ceased at the higher temperatures, because little or no oxygen was supplied to the kidneys. When subjected to an atmosphere of nitrogen, urine formation similarly ceased in normal frogs. By removing only the optic lobes, frogs were caused to gain weight, while breathing and urine formation continued. This was only temporary, for, 24 hours after operation, urine was being formed as fast as water entered the frogs, and the original body weights were soon restored. Hence it was only immediately after operation that anuria and edema developed. Whenever the frogs were able to survive, they usually were also able to restore their original water balances, and no part of the central nervous system was concerned specifically with kidney activity. Output of water in urine ceased in the absence of oxygen; yet survival of vital activities was indicated by complete recovery of all functions, including that of the kidneys, following renewal of the oxygen supply within 3 hours at 21°C.

27. The effect of narcotics (urethanes) on bacterial respiration and luminescence. G. Wellford Taylor, Princeton University. (Introduced by E. Newton Harvey.) (Lantern; 8 min.)

Marine luminous bacteria were used as indicators of their own rate of oxygen consumption by means of the dimming method of Harvey (see Taylor, Jour. Cell. and Comp. Physiol., '32, vol. 1, pp. 297). At the same time the luminescent intensity was measured on a photometer bench.

The effect of various urethanes upon respiration and luminescence was determined when the bacteria were in a nutrient (0.2 per cent peptone), as well as

in a non-nutrient medium. The luminescence and respiration are both reversibly narcotizable. The effect on luminescence is independent of the presence of peptone, while the effect on respiration varies in direction and degree with the presence or absence of nutrient in the medium and with the concentration of the narcotic. In a nutrient medium, high concentrations of the narcotics inhibit respiration, but a concentration sufficient to inhibit luminescence 50 per cent may have no effect on respiration; the same concentration of narcotic in a non-nutrient medium has the same effect on luminescence, but may at the same time increase respiration by as much as 60 per cent. The relative effectiveness of the urethanes on both respiration and luminescence increases with their molecular weight. Luminescence appears to be to a great extent independent of respiration.

28. Precipitins and phylogeny in animals. Alan Boyden, Rutgers University. (Lantern; 10 min.) (Also by demonstration.)

The precipitin test has been used in serologic studies of common Mammalia and Amphibia. The results indicating the degree of relationship of the species tested are expressed in quantitative terms, the statistical reliability of which is indicated by the usual methods. The per cent values measuring the interrelationships of the species can be expressed graphically only in 3 dimensions, and models, the dimensions of which correspond to these values, have been constructed.

Our previous knowledge of phylogeny has been gained mainly from morphology. That such knowledge is still uncertain is proved by the continual appearance of revisions of animal groups and by the fact that we still have major groups of uncertain systematic position. The morphologic method of investigating phylogeny has obvious limitations, such as the difficulty of distinguishing fluctuating form from hereditary form, the lack of quantitative methods for analyzing structural similarity and the consequent subjective nature of such analysis, the existence of convergence, and the great diversity of animal types. The serologic method of studying animal relationships has many advantages, such as its quantitative and therefore objective nature, its relative freedom from difficulty due to fluctuating variability and to changes during the life cycle, and its conservatism. Its greatest defect is its inability to analyze fossils. The serologic and morphologic methods should be considered complementary to each other, capable of checking each other's findings and thus of leading to more certain conclusions. Eventually, the two methods may be considered of about equal value in phylogenetic analysis.

29. A method of determining interfacial tensions within living cells. E. Newton Harvey and Herbert Shapiro, Princeton University. (Lantern; 7 min.)

By means of the centrifuge microscope (Harvey and Loomis, Science, vol. 72, p. 42, '30), it is possible to observe and photograph the deformation (flattening), due to centrifugal force, of oil droplets within living cells. From the flattening, density of oil and protoplasm, size of the oil droplet, and centrifugal force, the interfacial tension between oil and protoplasm can be calculated by the relation of Heydweiller (Wied. Ann., vol. 65, p. 311, 1898) or Dorsey (J. Wash. Ac.

Sci., vol. 18, p. 505, '28). Fish eggs with a single oil drop, or oil injected into cells with a surface membrane sufficiently strong to remain undistorted, offer the best material for research. Preliminary observations give very low values for the oil/protoplasm interfacial tension of fish eggs. By comparison with oil/water interfacial tensions a value for the total capillary activity of protoplasmic constituents can be given.

30. TRANSFUSION OF NEUROHUMORAL SUBSTANCES TO CHROMATOPHORES BY OTHER MEANS THAN BLOOD OR LYMPH. G. H. Parker, Harvard University. (Lantern; 15 min.)

A denervated area in the tail of a fish will change by the contraction or expansion of its melanophores light or dark as the general body of the fish changes light or dark, but at a rate much slower than that of the general body. The denervated area changes in tint because of the transfusion of light or dark exciting neurohumoral substances from the adjacent light or dark body area. This transfusion is so slow that it cannot be due to blood or lymph, but must be accomplished through tissue juices possibly as a fat-soluble material through the lipoid covering of cells. Such cellular transfusions must be common in the coelenterates, where, for instance, muscle relatively remote from sources of food must be supplied with nutriment.

31. THE CRUSTACEAN EYE HORMONE AND ITS EFFECT UPON THE CHROMATOPHORES OF CRUSTACEANS, FISHES, AND AMPHIBIANS. Earle B. Perkins and Benjamin Kropp, Rutgers University and The Mount Desert Island Biological Laboratory. (15 min.)

The active principle found in the eye stalk of many crustaceans which brings about contraction of chromatophores in these invertebrates has also been found to produce melanophore expansion in frog tadpoles by Perkins and Kropp, and melanophore contraction in fishes by Koller and Meyer. The effectiveness of the crustacean eye hormone in producing melanophore changes in vertebrates as well as invertebrates is noteworthy and calls for a survey of the extent to which the eye hormone may produce color changes in those animals which possess active chromatophores. Extracts of the eye stalks of Palaemonetes and Callinectes, in addition to producing chromatophore contraction in Palaemonetes and Crangon, also produced a marked melanophore expansion in frog tadpoles. When injected into fishes which normally undergo adaptive color changes, the eye extracts of a variety of decapod, and one schizopod, crustaceans were found to produce melanophore contraction. Determination of the range of effectiveness of the crustacean eye hormone in producing melanophore changes has been extended to include 16 species of crustaceans representing 9 families. The fishes whose melanophores have been found to contract following injection of crustacean eye extract are: Fundulus, some of the flat fishes, eels, and sculpins. Color changes in fishes are known to be regulated by nerves, and to some extent by adrenal and pituitary secretions. The response to an invertebrate humoral substance shows a wider susceptibility to hormone control and demonstrates further the range of effectiveness of the eye hormone.

32. The responses of caterpillars to sounds. D. E. Minnich, University of Minnesota. (Motion-picture machine; 12 min.)

Larvae of 14 different species of widely separated families of butterflies and moths were tested with tones from tuning forks of 256 v/s, 512 v/s, and 1024 v/s. When such a fork, held with the open end of the sound box 10 cm. above the larva, is given a vigorous blow, most of the larvae respond. The effectiveness of the different pitches varies somewhat from species to species, but none was found which was completely unresponsive. The response varies from mere cessation of locomotion to more or less violent contractions of the longitudinal muscles. In the latter case the anterior end of the body is usually the only part visibly involved, but in some cases the longitudinal muscles throughout the length of the body are affected.

33. Visual acuity of the fiddler crab, Uca pugnax. Leonard B. Clark, Columbia University and Union College. (Introduced by James W. Mavor.) (Lantern; 15 min.)

Wolfe and Hecht demonstrated the essential similarity of the relation between light intensity and visual acuity in the honey-bee and man. The present report presents evidence extending the relationship to the fiddler crab. In addition, it is shown that binocular and monocular visual acuity are similar, that certain types of visual behavior are related to the structure of the eyes, and that field observations in general confirm the findings in the laboratory.

34. The extent of the spectrum for Drosophila and the distribution of stimulative efficiency in it. Lloyd M. Bertholf, Western Maryland College and University of Munich. (Lantern; 15 min.)

Previous researches show that ultraviolet elicits responses in various arthropods, particularly honey bees, and that its efficiency is high compared to that of 'visible' light. How is it with Drosophila?

The flies were released directly in front of 2 irradiated areas placed side by side, one irradiated by white light of known intensity, the other by monochromatic light of known wave length. They went to one or the other of these 2 areas and were counted. By varying the intensity of the white and by using graphic interpolation, the intensity which would theoretically attract exactly half the flies was ascertained. This was done for about 30 wave lengths from 230 to 700 mμ. The results represented the relative stimulative effect of these different spectral zones. To get the relative efficiency, the energy at each wave length was measured and divided into the value for relative effect.

Results: The efficiency is very low in the longer wave lengths, but begins to rise at about 575 mμ, reaching a maximum in the 'visible' at 487 mμ. It then decreases as far as 425 mμ, then rises suddenly to an efficiency at 365 mμ, which is over 5 times as great as at any point in the 'visible.' From here it decreases constantly, except for a slight rise at 254 mμ, to zero at about 230 mμ. Shortest wave length at which definite response was observed, 235 mμ; longest, 650 mμ. It is also concluded that fluorescence cannot account entirely for the great efficiency of ultraviolet.

35. The rate of light adaptation in the eye of the drone fly, Eristalis tenax. William L. Dolley, Jr., University of Buffalo. (Lantern; 10 min.)

Because of the different results reported by various investigators in their studies of the rate of light adaptation in various organisms, a study of this phenomenon in Eristalis was made. Previous work showed that when the eye is exposed to illuminations of 12.37 m.c., 105.6 m.c., and 257.6 m.c., it becomes adapted to each of these illuminations in about the same length of time, 30 minutes. Further work with similar methods shows that when the eye is exposed to light of 100 m.c. it becomes adapted to this light in about 30 minutes, when it has been exposed to light of 200 m.c. for 20 minutes it is adapted to light of 100 m.c., while when it has been exposed to light of 400 m.c. for $2\frac{1}{2}$ minutes it is adapted to light of 100 m.c. These results may need slight revision if it is found that dark adaptation of one eye in Eristalis affects the rate of light adaptation in the other. Work is now being done to test this possibility.

36. Functioning kidney tubules in tissue culture. Robert Chambers, New York University. (Lantern; 10 min.)

In glomerular kidneys the question has always been open regarding the role of the glomeruli and of the tubules, respectively, in the secretion of urine. By means of a combination of the tissue culture with the micromanipulative method, it has been possible to study the activity of pieces of glomerular kidneys (bird and mammal), in which the glomeruli have been rendered functionless. The proximal tubules possess a one-way permeability (from without inward), for phenol red, strong acids, and water, which accumulate in their lumina against high pressures. This one-way permeability is temporarily lost by exposure to cold, KCN, and CO, and not to the same extent to urethane. Under these conditions, the cells of the tubules, nevertheless, will color with the usual vital stains. The distal convoluted tubules are not permeable in either direction for phenol red, and the indications are that water passes through their walls only from within outward.

37. A micromanipulative study of capillary reactions to mechanical stimulation. B. W. Sweifach and Robert Chambers, New York University. (Lantern; 5 min.)

The micromanipulative method was used to study the effect of localized mechanical stimulation upon the various cellular elements visible in the capillary wall of the frog mesentery. The following facts have been established by the experimental data procured.

Mechanical stimulation applied locally to the capillary wall does not affect the whole length of the vessel. It is only when the stimulus is spread over a considerable length of the capillary that reactions involving whole lengths of a capillary vessel will occur. Local stimulation anywhere along the endothelial wall will bring about a constriction at the point stimulated. Each endothelial cell can be made to react independent of its neighboring cells. Some cells will not react as easily to mechanical stimulation as others. The state of distention of the capillary wall is one of the determining factors in the ease of reaction to mechanical stimuli.

Encircling lines appear at constricted points in the capillary wall when the vessel is in a state of contraction. These lines are most prominent where the capillary joins with an arteriole or venule. It is here that constriction tends to go through to its fullest extent. A detailed study of the micromanipulative production of such lines leads to the conclusion that they are due to folds in the endothelium itself.

Prodding every visible cell adjoining the capillary wall, in an attempt to stimulate them mechanically, brought no constriction of the capillary wall at that point. After removal of such cells by means of a microneedle, stimulation of the underlying endothelial cells brought forth all the typical signs of local endothelial constriction, viz., the endothelial nucleus will round up, bulge into the lumen of the vessel, and the endothelial cell will show ridges or folds on its surface.

38. THE BIO-ELECTRIC PROPERTIES OF LIVING FROG SKIN. H. B. Steinbach, University of Pennsylvania. (Introduced by L. V. Heilbrunn.) (Lantern; 10 min.)

Living frog skin, when used as a partition separating 2 chambers filled with Ringer's fluid, functions as would an electrode with 2 faces of different properties. It can be shown that the total skin potential measured across the skin from solution to solution, is the algebraic sum of the potential difference between the skin and the 'outside' solution, plus that between the skin and the 'inside' solution. The skin is negatively charged to the inside and positively charged to the outside solution.

The two sides respond differently and independently to changes in the concentration of the medium applied to them. The inside potential shows little change with dilution, the outside shows a peculiar maximum point in the P.D./log. conc. curve.

The different cations have specific effects upon the 2 sides of the skin. Arranged in the order of their effect upon the sign of charge of their solutions with respect to the skin, for the inside, $+\ Ca => Na > Mg,Sr >> K-$ and for the outside $+\ K > Mg,Sr > Ca >> Na-$. The order suggests a chemical effect upon some system within the skin rather than a purely physical result of the migration of the ions of the applied electrolyte.

From these experiments it is concluded that the skin potential cannot be interpreted on the basis of the diffusion of electrolytes through an inanimate membrane, but must depend on internal constituents of the skin.

39. HISTOLOGICAL CHANGES IN NON-REGENERATING LIMBS OF X-RAYED AMBLYSTOMA LARVAE. E. G. Butler, Princeton University. (Lantern; 15 min.)

It has been previously demonstrated that x-radiation in sufficient dosage prevents the regeneration of the limb in Amblystoma larvae (Butler, '31). This effect occurs regardless of the age of the larvae or the stage of limb development at the time of amputation. Histological study has been made of the non-regenerating limb stumps of radiated larvae in comparison with normally regenerating limbs. Results show that the primary effect of radiation is a complete blocking of the differentiation processes within the amputated limb. At the distal end of a non-regenerating limb stump a condensation of cells occurs

resembling the formation of the blastema in a normally regenerating limb. These cells, however, show no indication of differentiating into the components of a new limb. In normally regenerating limbs one of the first components of the new limb to be formed from the blastema is the cartilage. In radiated embryos not only is there no indication of cartilage formation, but also the old cartilage within the stump is seriously affected. Beginning distally, the old cartilage gradually 'melts away' and disappears. This process continues till all of the cartilage within the limb has vanished. The non-regenerating limb stump of a radiated embryo is then a shrunken stump devoid of cartilage and composed principally of scattered cells which have the general appearance of undifferentiated mesenchyme cells.

40. Physiological effects of x-rays on larvae of the mud-dauber wasp, Sceliphron caementarium (Hymenoptera). J. H. Bodine and T. C. Evans, State University of Iowa. (Lantern; 5 min.)

In a previous report it has been shown that the diapause phenomena modified quantitatively the response of the organism to changes in temperature. It has likewise been found in preliminary experiments that the diapause phenomena modify the reaction of the organism to unfiltered Roentgen irradiation. Intensities of irradiation which stimulate development of the non-diapause individual will lengthen the time before development is initiated in the case of the diapause organism. On the other hand, doses which are inhibitive and even lethal to the non-diapause organism will be neutral or even stimulative to development in the diapause individual.

41. The action of ultraviolet rays on Amoeba protoplasm. L. V. Heilbrunn and Kathryn Daugherty, University of Pennsylvania. (Lantern; 5 min.)

Ultraviolet rays produce stimulation in practically all types of living material. It is of interest, therefore, to determine the effect of these rays on protoplasm.

Centrifuge tests of Amoeba dubia show clearly that ultraviolet rays cause a sharp increase in the viscosity of the main mass of the protoplasm or plasmasol. On the other hand, centrifuge tests of Amoeba proteus show that the rays produce a marked liquefaction of the outer stiff plasmagel. In view of the fact that liquefaction of the plasmagel may be caused by removal of calcium, and that, moreover, calcium is set free from both non-living and living colloids by irradiation, it was thought that the stimulating effect of ultraviolet rays might be primarily due to a release of calcium from the plasmagel. Once this calcium is set free from the cortex, it may diffuse into the interior and produce changes there. On the basis of earlier experiments, we know that small amounts of calcium cause lowered viscosity of the interior protoplasm, and that larger quantities cause gelation. Hence, if our theory is correct, we might expect that stimulation should first produce a lower viscosity of the interior protoplasm, and then, with the entrance of more calcium, gelation. This could be clearly shown to occur.

Our results therefore indicate that the effect of ultraviolet rays is to cause a breakdown of a calcium gel in the cortical protoplasm, a breakdown which releases calcium to the interior, where it produces gelation after a preliminary decrease in viscosity.

By demonstration

42. Demonstration of sperm tubes used in the study of the swimming ability of spermatozoa. B. H. Grave, De Pauw University.

No abstract received.

43. Some easily made and inexpensive physiological apparatus. James W. Mavor, Union College.

1. An apparatus for recording the muscle twitch suitable for student use. With the apparatus the latent period, summation, and the rate of propagation of the nervous impulse can be accurately demonstrated.

2. An attachment for an ordinary electric clock giving signals at intervals of minutes and hours.

3. A reducing gear adapted from a spring victrola motor.

4. A holder for platinum electrodes.

44. Hydrogen-ion activity changes in Galleria mellonella during metamorphosis as determined by a glass electrode with microvessel. Ivon R. Taylor and James H. Birnie, Brown University. (Introduced by the Secretary of the Society.)

The measurements were made on the body fluids of animals taken individually at various stages during metamorphosis with satisfactory accuracy (within $\pm$ 0.02 pH) by means of a glass electrode. The assembly employed a sensitive thermionic vacuum-tube potentiometer and the fluid under measurement was contained in a closed microchamber requiring only 0.03 cc. of fluid and preventing the loss of carbon dioxide. The animals were raised at 30°C. and the measurements were also made at this temperature. The body fluids were found to be always acid in reaction, the pH values ranging from 5.53 to 6.68 during prepupal and pupal development. The curves for hydrogen-ion activity of both sexes were found to be of the general U-shaped type and sex differences appeared which are probably significant. It was found possible to determine the sex of the pupae by noting the shape of the wings as shown through the chitinous covering. In general, the hydrogen-ion activity curves parallel the oxygen consumption, carbon-dioxide production and glucose concentration curves previously reported for these animals during pupal development.

45. The measurement of the growth of mussels from x-ray pictures of the shells. Oscar W. Richards, Yale University.

The rings, showing periods of retarded growth, do not show clearly on the shell of the Pacific Coast mussel, Mytilus edulis, especially on older animals where the shell is worn from the rubbing of the animals against each other in the mussel beds. Pictures of the shell made with x-radiation show the rings clearly and permit measurement of the rings. These measurements may be used to construct the growth curve of this species with more precision than has hitherto been possible.

By title

46. ATTEMPTS TO END THE DORMANCY PERIOD OF SOME CLADOCERA SEXUAL EGGS. Thelma R. Wood and A. M. Banta, Brown University and Carnegie Institution of Washington.

Presumably cleavage stages occur just after the egg is laid, after which development ceases and the resting stage ensues. Expedients used to end this dormancy period (Daphnia longispina) include storage dry at room temperatures 10 days to 3 years; freezing; storage wet or dry at 5° or 10°C., one to 4 months; aeration of culture water; relative effects of direct sunlight, diffuse daylight, and darkness; periodic loosening of egg cases from sides of bottle; relative effectiveness as medium of rain water, pond water, and dilute filtered manure infusion; and periodic changing of water on eggs as compared with replenishing such water as is lost by evaporation. Most of these expedients, including freezing or storing the eggs at low temperatures, did not improve their hatchability. Prolonged desiccation (over 3 months) reduced hatchability; storage wet for similar periods was less harmful. So far as learned, Daphnia sexual eggs must have been dry before the dormancy period can be ended (hatching) and maximum hatching is induced by keeping them dry at room temperature for 10 days to 3 months, followed by addition of dilute filtered culture medium and changes of this medium at 10-day to 2-week intervals thereafter. Inbreeding, a large number of previous generations of parthenogenesis, and certain genetical physiological characteristics limit the hatchability of sexual eggs.

Many Moina macrocopa sexual eggs, on the other hand, developed promptly (2 to 24 days) after being cast and without drying. Others hatched only after a short (dry) dormancy period.

47. IS THE USUAL BALANCED PHYSIOLOGICAL MEDIUM SUITABLE FOR AVASCULAR FRESH-WATER ANIMALS? Alford Hetherington, Johns Hopkins University. (Introduced by S. O. Mast.)

The salt systems bathing the tissues of higher animals may be roughly characterized as dilute sea water.

In striking contrast to these solutions in which the sodium is 30 to 50 times more concentrated than the calcium, are the dilute salt systems in which avascular fresh-water animals are found. Two salient characteristics emerge from a review of a number of analyses of different fresh waters: 1) they are much more dilute than the blood of higher forms, being commonly about 0.01 per cent total salt; 2) the calcium is quite generally more concentrated than the sodium and the potassium together.

Amos W. Peters ('04) derived the following cation system for the large and delicate ciliate Stentor coeruleus: Ca^{++}, 0.00055 M.; K^{+}, 0.0003 M.; Mg^{++}, 0.00015 M.; and Na^{+}, 0.00015 M. Osterhout ('07) showed that certain fresh-water algae tolerate dilute artificial sea water even when the total salt concentration is as high as 0.6 per cent. Miss Murray ('28), working on Planaria dorotocephala, arrived at a medium closely resembling Peters'. My paper ('32) on the culture of Stentor compared the balanced medium of Osterhout with that given by Peters, finding the latter essential for continued survival. Hahnert ('23) arrived at a medium for Amoeba proteus closely resembling that given by Peters.

It is concluded that small forms will tolerate the balanced physiological medium, but that for the larger and more delicate avascular fresh-water animals a salt system approximating Peter's medium is not only more favorable, but essential to continued growth.

48. Growth retardation with suboxidized cystin. Frederick S. Hammett, Marine Experimental Station, Res. Inst. Lankenau Hospital, North Truro, Massachusetts.

When, 3 years ago, it become evident that cell-proliferation growth is regulated by the naturally occurring chemical equilibrium composed of SH and its partially oxidized derivatives, I put up to Dr. Gerrit Toennies of our Institute the chemical problem of preparing suboxidized cystin. This was desired for theoretical and practical purposes. First, as validating the postulate; secondly, as providing a water-soluble, non-toxic, relatively stable, retardant of proliferative growth derived from a naturally occurring growth accelerator. There was made available this summer by Doctor Toennies 400 mg. of a compound having the desired physical and chemical properties. This was definitely retardative of growth of Obelia commissuralis in concentration of 8×10^{-7} S as suboxidized cystin. This is the order of effective magnitude for S as sulphoxide obtained in previous work. It was found that the compound held back formation of new organisms by 36 per cent, the growth of early stages by 30 per cent, and that of gonophores by 34 per cent. These are largely expressions of cell-multiplication growth. Contrasting this with the fact that organization growth of the almost completely developed hydranths to maturely functioning organisms was only slightly retarded, gives proof that the primary seat of action was on the process of cell multiplication. Thus, through the use of these naturally occurring chemical groups, chemical prediction has been fulfilled and the biological postulate completely validated. From this, retardation of neoplastic growth may eventually be possible.

49. The effect of –SH on the growth of Chilomonas paramecium. Theo. L. Jahn, Yale University. (Introduced by the Secretary of the Society.)

When grown under anaerobic conditions, in a bacteria-free medium of hydrolyzed casein (pH 6.7), Chilomonas paramecium shows a very low division rate (0.29). Accelerations of as much as 100 per cent in the division rate may be produced by the addition of 0.0015 per cent H_2S to the medium. When 0.023 per cent H_2O_2 is present in the medium, no growth occurs in the controls, but a division rate of about 0.60 occurs if both 0.023 per cent H_2O_2 and 0.01 per cent H_2S are present. At present, 2 explanations seem possible: 1) The acceleration is due to an optimal concentration of –SH in accordance with the sulphydril hypothesis of Hammett. 2) The acceleration is at least partly due to an optimal redox potential, produced in the medium by the action of –SH and/or H_2O_2. However, the possibility that the reversible –SH oxidation-reduction system might act as an oxygen reserve under anaerobic conditions must also be considered, for the medium was under aerobic conditions during preparation.

Since the redox potential has not been controlled in any of the experiments in support of the sulphydril hypothesis, it seems possible that differences in redox potential produced by –SH compounds might account for at least some of the results obtained by Hammett and co-workers. Since –SH is a reducing substance, the theory that –SH is a specific accelerant of mitosis cannot be demonstrated unless the redox potential of the medium is controlled. As yet, to the knowledge of the writer, this has not been done.

50. The effect of certain organic acid radicals on growth of Euglena gracilis. Theo. L. Jahn, Yale University. (Introduced by the Secretary of the Society.)

Euglena gracilis was grown in a medium of hydrolyzed casein and inorganic salts (pH 6.7) to which sodium salts of various organic acids were added (M/160). The initial and final (after 9 to 14 days) concentrations of organisms were determined. Assuming logarithmic growth, division rates in the light and dark, respectively, were as follows: control, 0.392, 0.046; formate, 0.386, 0.040; acetate, 0.545, 0.265; proprionate, 0.545, 0.265; butyrate, 0.595, 0.280; lactate, 0.425, 0.171; citrate, 0.392, 0.046; oxalate, 0.437, 0.046; succinate, 0.287, 0.079; tartrate, 0.392, 0.046. Similar results were obtained with equinormal (N/160) concentrations of the organic salts. The above figures show the relative accelerating power on cell division of the radicals tested.

51. Experimental production of cataract in trout. Walter N. Hess, Hamilton College.

Since it is known that trout of the more common species frequently develop cataract under artificial conditions, an effort was made to determine what factors are responsible. Experiments were undertaken to investigate cataract development in young rainbow trout under 5 separate conditions: light, heredity, contagion, calcium in the water, and food. To test the effects of light, some of the troughs containing fry were covered while others were left uncovered. To test the hereditary factor, the fry in some of the troughs were obtained from parents that had cataract, while the fry in other troughs came from trout that were seined from Seneca lake and did not have cataract. In one small pond, fish possessing cataract were kept with marked fish without cataract to test the possibility of contagion. Some fish were kept in water low in calcium salts, while others were kept in water containing a large amount of calcium. Finally, part of the fry were fed pig spleens, a food that has been extensively used during recent years for artificial propagation of trout, especially in the hatcheries where cataract was found to be most prevalent. Control fish were fed a combination of beef heart and beef liver. The experiment ran from June second to September tenth. At its close 17.4 per cent of the fish in the spleen-fed troughs had cataracts, while all others were free of the defect. Histological sections of the lenses showed marked degeneration of lens tissue in the anterior polar region. It was concluded that the cataracts in these fish were caused by improper food.

52. Changes in the glucose content of the Japanese beetle (Popillia japonica Newman) during metamorphosis. Daniel Ludwig, New York University.

Determinations of the total glucose content of 150 Japanese beetles in different stages of metamorphosis were made by means of the Hagedorn Jensen method. The glucose content of feeding third-instar larvae average 0.49 per cent, of early prepupae 0.45 per cent, and of late prepupae 0.50 per cent. Readings on pupae, which had molted within the previous 24 hours, showed a much higher glucose content (0.71 per cent). The percentage of glucose decreased to 0.62 in individuals 2 to 3 days after pupation (pupae were kept at 25°C.) and then steadily increased until a maximum of 0.84 was reached at the end of the pupal period.

53. Possible factors in the molting mechanism of newts. A. E. Adams and M. C. Grierson, Mount Holyoke College.

Thyroidectomized and normal Triturus viridescens (aquatic adults) were used to examine possible factors in the molting mechanism. The role of a water environment was tested by placing animals in moist chambers; that of cutaneous gland function by injections of pilocarpine and atropine to release and inhibit the release, respectively, of their secretion; that of the cutaneous circulatory condition by injections of sodium nitrite and ephedrine or epinephrine to increase and decrease, respectively, the cutaneous lymph supply.

Normal animals molted in moist chambers, but the variations recorded after injections of the above drugs seemed of no significance because of the wide range of variation in uninjected normals. The drugs did not induce molts of thyroidectomized animals, but thyroxin-injected thyroidectomized animals molted in moist chambers, although after a significant delay compared with the reaction in water. Neither pilocarpine nor sodium nitrite injected simultaneously with thyroxin hastened the molting of athyroid animals as compared with ones receiving thyroxin only. Atropine with thyroxin did not retard thyroxin-induced molts, but ephedrine or epinephrine with thyroxin slowed the reaction. These data seem to indicate, 1) that water facilitates the loosening of the cornified epidermis, but is not essential to the molting mechanism; 2) that cutaneous glands play no part in the mechanism; 3) that a change in the cutaneous circulatory condition probably is a factor in the mechanism.

54. Molting of newts under laboratory conditions. Margaret C. Grierson, Mount Holyoke College. (Introduced by A. E. Adams.)

Records were kept for 16 weeks of the molting of 33 adult Triturus viridescens which had been in the laboratory 3½ months prior to observation. Marked individual variation in the interval between molts and in the duration of single molts appeared in the records. The average number of molts for these animals for the 16-week period was 4.97, ranging from 1 to 9. The average interval between successive molts, i.e., from the end of one molt to the beginning of the next, was 13.19 days. The interval between the molts varied from 0 to 59 days. Single molts lasted from 1 to 28 days, with an average of 7.8 days. Nearly

one-fifth of the molts recorded were completed in one day. It seems probable that the short duration of molting is typical of what occurs in nature. During the period of observation, the group was molting about 34.8 per cent of the time. This is a higher frequency than that recorded by Adolph and Collins ('25, J. Morph., vol. 40, p. 575), whose animals molted 9 per cent of the time after being in captivity for 3 months and 22 per cent of the time after 5 months. However, the increase to 34.8 per cent after a longer stay in the laboratory (7½ months) is consistent with their data.

55. A QUANTITATIVE STUDY OF THE OXYGEN CONSUMPTION OF SINGLE DEVELOPING EGGS (ORTHOPTERA). J. R. Burkholder, State University of Iowa. (Introduced by J. H. Bodine.)

Respiratory metabolism of single grasshopper eggs (Melanoplus differentialis) during their entire course of development has been determined.

1. A rhythmic rise and fall in oxygen consumption occurs during successive morphological periods. There is a gradual increase up to the ninth day of development. From this point of formative activity there is a gradual fall, ending in a state of quiescence (diapause) where the use of oxygen is at a minimum. Following diapause, an increase in consumption occurs, marking the revolution of the embryo and continues through the period of yolk engulfment, reaching a maximum at hatching.

2. Total volume of oxygen consumed by each egg, as well as the percentage of the total volume used during each period of embryonic development, has been measured. The volume used by various eggs during corresponding intervals of growth shows a close correlation irrespective of: *a*. The difference in total volume used; *b*. The differences in volume used during respective periods; *c*. The differences in time required to cover the respective developmental intervals.

3. When, for physiological reasons, the oxygen consumption for a period varies either as to amount of energy used or time required to complete developmental period, the following period tends to compensate for the difference.

56. STUDIES ON THE OXYGEN CONSUMPTION OF FRESH-WATER FISHES. H. C. Burdick, State University of Iowa. (Introduced by J. H. Bodine.)

The oxygen consumption of the fish studied was measured in a 'flowing water system' using the Winkler method of oxygen analysis. Experiments were performed at 26°C.

The fish used have been white crappie (Pomoxis annularis, Raf.), black bullhead (Ameiurus melas, Raf.), and channel catfish (Ictalurus punctatus, Le Sueur).

The data obtained have been analyzed by taking moving means of 5 or 10 animals for weight, oxygen consumption per unit weight and time, and oxygen consumption per unit area and time.

The oxygen consumption of each species of fish employed is found, when expressed as cubic centimeters of oxygen per unit weight and time, to decrease as the weight of the fish increases.

The oxygen consumption of each species of fish employed is found, when expressed as cubic centimeters of oxygen per unit body area and time, to be nearly constant regardless of the weight of the individual.

The preceding observations are most clearly illustrated by data from the channel catfish. Here the oxygen consumption expressed as cubic centimeters of oxygen per 100 grams per hour, is found to vary from 31.2 to 11.8. When expressed as cubic centimeters per 100 sq.cm. body area it is found to be nearly constant at about 5.0.

57. Effect of sublethal concentrations of sodium chloride on the oxygen consumption of anuran larvae. W. B. Buchanan, New York University. (Introduced by O. M. Helff.)

The toxicity of Na, Ca, and K ions on R. clamitans larvae was determined as K>Ca>Na when in 0.1 to 0.4 M concentrations of their chlorides. Since larvae lived for over 12 hours to 0.1 M and 0.2 M NaCl, these concentrations were employed in determining the effect on oxygen consumption. All oxygen-consumption tests were made using the Winkler method.

The normal, average, hourly variation in oxygen consumption of 30 larvae, tested individually for 4 consecutive hours, amounted to 12.8 per cent. The average variation of 20 larvae tested in 0.1 M NaCl was but 5.6 per cent, giving no evidence of an influence on oxygen consumption, except possible reduction of the normal hourly variation. A depression averaging 31.3 per cent was recorded, however, when using 0.2 M NaCl. Comparison of this figure with the normal hourly variation leaves no doubt that a definite depression occurred. Similar tests were run using R. catesbeiana larvae. The normal hourly variation amounted to 10.3 per cent, while 0.2 M NaCl was found to depress oxygen consumption 23.6 per cent.

The rate of recovery of R. clamitans larvae from 0.2 M NaCl was also studied. An increased depression in oxygen consumption was recorded during the hour succeeding the salt-test hour. This is due, probably, to the continued effect of the salt solution applied during the preceding hour. Partial recovery was evidenced, however, within 2 hours following the salt-test hour. Apparently, recovery from NaCl depression is a relatively slow process.

58. The blood and blood-forming organs of the salamander, Plethodon cinereus. H. E. Jordan, University of Virginia.

The blood cells of the terrestrial salamander, Plethodon, resemble very closely those of the aquatic salamander, Triturus viridescens. The most striking difference relates to the eosinophilic leukocytes, which in Plethodon are smaller and contain much finer granules. The blood contains considerable numbers of hemocytoblasts and lymphocytes. These constitute the lymphoid hemoblasts, the hemocytoblasts representing young lymphocytes. The large lymphocytes differentiate into erythrocytes; the small, into thrombocytes.

As in Triturus, the liver of Plethodon is enveloped by a continuous subcapsular layer of lymphogranulocytopoietic tissue, more extensive over the apices. Here are produced the eosinophils and neutrophils. The basophils arise in the spleen. Neither mesonephros nor gonads contain granulocytopoietic tissue. Vertebrae and leg bones also lack hemopoietic tissue. The submucous layer of the gut contains great numbers of very irregular mast cells, apparently of local origin. Erythrocyte and thrombocyte production are restricted to the spleen, in

the sense that the ancestors of these cells arise here. A certain amount of differentiation occurs locally, but the lymphoid hemoblasts are largely delivered to the blood where they proliferate and differentiate within the peripheral circulation. The terrestrial habit of Plethodon has apparently little specific effect on the character of the blood cells and the loci of their formation, as compared with aquatic forms like Triturus.

59. The hemocytopoietic effect of liver extract in the frog. H. E. Jordan and J. R. Shanklin, University of Virginia.

The extract was no. 343, Lilly, used intramuscularly. A group of 7 controls gave an average red cell count of 550,000 per cmm. Seven experimental animals gave an average count of 477,000. Counts were made 3 days after an injection, ranging from the first to the eighth, with a dosage varying from 1/10 to 1/20 cc., given at weekly to 4-day intervals.

One animal without food gave a count of 480,000 after the first injection, 440,000 after the fifth, 400,000 after the seventh. A specimen that ate well had a count of 590,000 after the first injection, 610,000 after the fifth, 580,000 after the seventh. Four animals starved for 2 weeks gave an average count of 292,500; after a month of feeding, combined with several injections of liver extract, the average count rose to 380,000. One of the starved specimens, given 8 injections, had a first count of 270,000; after the sixth and eighth injections, the count was 380,000.

The extract was ineffective in stimulating the normally hypoplastic bone marrow to hemopoietic activity. The spleen of the injected specimens showed a uniform condition after the second injection: much pigment, sinuses well filled with blood, relatively little reticular stroma and few nodules, almost complete absence of dividing cells, and active differentiation of hemoblasts into erythrocytes. However, one animal among the controls had a spleen in practically identical condition. Since the peripheral blood-cell count averaged lower than in the normal, it remains doubtful whether the liver extract had a specific erythrocytopoietic effect on the spleen.

60. Hydrogen-ion concentration of the blood of anuran larvae during involution. O. M. Helff, New York University.

The blood pH of 25 normal larvae of Rana clamitans was determined by means of the quinhydrone method. An average pH of 7.50 was obtained.

Two intermediate stages of metamorphosis were tested (25 cases of each), showing an average progressive decrease in pH to 7.39 and 7.27, respectively.

The average blood pH of 25 animals, immediately following the completion of involution, amounted to 7.20. It is concluded that a definite increase in the hydrogen-ion concentration of anuran blood occurs during larval transformation amounting to an approximate drop of 0.3 of a pH.

The average blood pH of newly metamorphosed frogs, 3 to 4 weeks after the completion of metamorphosis, was determined as approximately 7.18. It is concluded that little, if any, change in blood pH occurs within 3 to 4 weeks following the completion of larval involution, although changes may occur during future adult growth.

The results are discussed in general and suggestions offered regarding the relationship between the increase in hydrogen-ion concentration of the blood and the various degenerative changes which occur during larval involution.

61. Studies on the pH changes of body fluids during metamorphosis in an insect, Sceliphron caementarium (Hymenoptera). W. M. Booker, State University of Iowa. (Introduced by J. H. Bodine.)

By means of a microquinhydrone electrode the pH values of the body fluids of the larval, prepupal, and pupal stages of the mud-dauber wasp have been determined. Definite correlations exist between the pH of the body fluids and the stages of metamorphosis. The pH values of larval blood range from 6.60 to 6.80; for prepupal stages, 6.50 to 6.30; for pupae 6.43 to 6.35.

62. Quantitative studies on precipitins. Joseph G. Baier, Jr., University of Wisconsin. (Introduced by William H. Cole.)

This paper deals with the application of a new quantitative volumetric precipitin technique applied to a study of precipitate volume measurement (using Van Allen thrombocytocrits) as influenced by the effect of various physical and chemical factors on antigen-antibody union. The relations of antigen to antibody have been shown quantitatively using simple and complex protein antigens (crystalline egg albumin, oxyhemoglobin, serum proteins) as affected by, 1) dilution of antigen and, 2) dilution of antiserum. The volume of precipitate was found to be directly proportional to the reaction temperature between 0°C. and 63°C. The optimum time of incubation was about 90 minutes at 37°C. The time and rate of centrifugation for packing of the precipitate was found to be suitable at 2400 R.P.M. for 30 minutes, as seen statistically. The formation of precipitate was observed between a pH of 4.6 and 8.5 with little change in volume between pH of 6 to 8, while below pH 4.6 or above 8.5 no visible precipitation occurred. Increase in the salinity of the incubation mixture of antigen and antibody causes a progressive slight decrease in volume of precipitate up to 20 per cent salinity. From 20 to 30 per cent salinity the salting-out effect of the serum proteins is evident. The presence of a foreign protein (beef serum) in the reaction mixture of antigen and antibody causes an increase in the volume of precipitate obtained. The probable error has been used as a measure of the degree of reliability to be placed on the results.

63. Serological studies of tissue antagonism in the domestic fowl. A. W. Kozelka, University of Chicago. (Introduced by F. R. Lillie.)

Agglutination tests were made with both monovalent and polyvalent sera, prepared by immunizing rabbits with washed fowl's corpuscles, on birds belonging to 7 more or less inbred strains of fowls. The results of agglutination tests of the various birds were correlated with compatibility to integumental grafts of corresponding birds.

Transplants between individuals with practically identical agglutinogens or transplants between individuals in which the donor did not have additional agglutinogens were absorbed about as frequently as those between individuals

in which there were agglutinogens in the donor that were absent in the host. This can only mean that the factors responsible for absorption of foreign tissue are not identical or associated with the factors causing agglutination with immune serum. The fact that only a small percentage of homoioplastic grafts between half and full brothers and sisters in inbred adult birds persisted points to the conclusion that the regression of grafts is due to slight biologic differences; the rate of regression is undoubtedly determined by the extent of difference between donor and host.

In view of the similarity in the complexity of both chicken and human bloods as indicated by immune sera, it does not appear probable that iso-agglutinins in humans are indicative of incompatibility in tissue transplantation.

64. The ovary of the rat after hypophysectomy. Olive Swezy and Richard I. Pencharz, University of California.

Eight rats were hypophysectomized at times varying from 12 to 90 days before autopsy. A single ovary of each was serially sectioned and exact counts were made of all ova and follicles which it contained. An equal number of normal rats were studied in the same manner. It was found that the number of ova and follicles in the hypophysectomized rats was about twice the total number of ova and follicles in the normal rats. There were abundant evidences of the formation of new germ cells from the germinal epithelium, as well as much atresia in the existing ova and follicles, indicating that the larger number was not due to an accumulation, but was due to an actual increase in the rate of ovogenesis. This increase in the rate of ovogenesis is the result of the removal of the repressive influence of the maturity hormone of the anterior pituitary. The hypophysectomized group included both pregnant and non-pregnant rats at the time of operation. There were no differences observable between the 2 groups except that the latter had consistently smaller corpora than the former. The largest follicle in these ovaries was 270 μ in longest diameter, though only a few were much advanced beyond the primordial stage.

65. Ovogenesis and the hypophysis. Olive Swezy and Herbert M. Evans, University of California.

When the total number of ova, follicles, and corpora are counted in the ovaries of rats which have received implants of rat hypophyses (maturity hormone) for periods varying from 9 to 20 days, it is found that these treatments have a repressive effect on ovogenesis and on the growth of follicles. The large ovaries that are thus produced have consistently fewer ova and follicles than the controls. This effect is correlated with the luteinizing hormone. In the immature rat, where no corpora are formed as the result of such treatments, the total number of ova and follicles is greater than in its litter mate with many corpora in the ovary, though still below that of the control. The growth hormone has no effect on ovogenesis, though it may inhibit the effect of the maturity hormone and thus allow ovogenesis to proceed unhindered, or even accelerate to the rate found in the hypophysectomized rat.

66. Changes in the skin of normal and gonadectomized 'red phase' Triturus following phyone injections. A. E. Adams, Mount Holyoke College.

A series of immature ('red phase') Triturus viridescens was gonadectomized. Ten days after the operation, injections of phyone (Van Dyke and Wallen-Lawrence) were begun. Loss of the brick-red or red-orange color with gradual appearance of the greenish or green-brown color typical of the adult aquatic form took place. The change usually began within a week or 10 days after the first injection (0.25 cc. of a 1: 10 solution of phyone being given daily) and became marked as treatment continued. The animals molted frequently and the skin lost its translucency and papillation and became smooth. Cutaneous glands were also stimulated to release their secretion, and the animals were very slippery when handled. A control series of non-gonadectomized animals injected with phyone also underwent similar changes in color and texture of the skin (see also Adams, '32, Anat. Rec., vol. 52: Suppl., p. 46). Gonadectomized and normal 'red phase' animals left untreated kept the usual characteristics of the skin. From these data, it appears that the gonads are not essential factors in the skin changes induced by phyone (anterior pituitary) injections. They further suggest that the changes in coloration and skin texture which occur normally in the life history of Triturus viridescens may accompany rather than depend on the maturing of the gonads.

67. The effect of injections of human pregnancy urine, and an extract of that urine on the reproductive organs of the immature male rat. Earl O. Butcher, Hamilton College.

Daily injections of 1 cc. of pregnancy urine for 10 to 15 days into prepubertal male rats produces marked changes in the reproductive structures. Increase in size and accelerated secretory activity occur in the prostate and seminal vesicles. Interstitial-cell hypertrophy and tubular enlargement are responsible for a much larger testis. Spermatogenic activity is greatly inhibited. Mitosis in the seminiferous tubules is reduced, and the germ cells increase slightly more than a single layer in thickness.

Antuitrin-S (an extract obtained from pregnancy urine by Parke, Davis & Co.) produces similar effects when injected subcutaneously with the exception that spermatogenesis is greatly accelerated. The interstitial cells are, therefore, not responsible for decreased spermatogenic activity.

68. Effect of blood from pregnant women upon proliferation in the uteri of virgin mice. Reginald G. Harris, the Biological Laboratory, Cold Spring Harbor, New York.

Among mammals proliferation of the uterine mucosa normally occurs early in pregnancy (progestational proliferation). Typical progestational proliferation has been produced in uteri of virgin rabbits by injections of extracts of corpora lutea (particularly by G. W. Corner, using 'progestin'). Similar consistent results have not been obtained in rats (Willard M. Allen) nor in mice and rats (Harris, unpublished).

Using untreated blood serum from pregnant women, progestational proliferation has resulted in normal virgin mice. Usually daily injections of 1 cc. of serum were given for periods of from 6 to 10 days, beginning the day after the mouse was on oestrous. Of 76 animals treated with serum from an equal number of pregnant women and studied thus far, over 90 per cent showed marked proliferation in all or some parts of the uterus. Marked proliferation appeared whether or not the animal accomplished its oestrous cycle during the course of the injections. Even in animals which were on oestrus just previous to autopsy, progestational proliferation may be strikingly apparent. Proliferation was produced by serum from all periods of human pregnancy from the first month onward.

Proliferation apparently also occurs in ovariectomized mice when similarly treated. Proliferation does not seem to result from treatment with serum from men (5 cases), nor from non-pregnant women (5 cases), whether menstruating or between menstrual periods, or whether the mouse is ovariectomized or not.

None of 12 untreated controls showed progestational proliferation. These cases included animals in all stages of the oestrous cycle, immature animals and ovariectomized animals.

69. The effect of many corpora lutea on germ-cell formation and growth in the ovary of the white rat. Earl O. Butcher, Hamilton College.

Numerous corpora lutea have been induced in the ovaries of rats by daily subcutaneous injections of human-pregnancy urine. Corpus-luteum extract has also been given daily subcutaneously to other rats. A comparison of the different ovaries shows that germ-cell proliferation from the germinal epithelium is inhibited by the space relations and pressure of the numerous corpora lutea and not by corpus-luteum hormone. Where numerous corpora lutea are induced by injections of pregnancy urine, the following is revealed: 1) The germinal epithelium grows rapidly to relieve the pressure and congestion caused by the numerous lutea. Some germ cells are proliferated. Growth activity is greatest near the hilus. When the formation of corpora lutea is no longer stimulated, the germinal epithelium overcomes the crowded condition by an extensive growth. 2) The growth potentiality of the germinal epithelium is greater in young adults than in immature rats. That in old rats is practically nil. 3) Most of the growing follicles are either overtaken by degeneration or are luteinized, and their maturity thus prevented. 4) It is suggested that the luteinizing hormone of the pituitary may be more responsible than the corpora lutea for the prevention of ovulation. In other words, when the luteinizing stimulus is present, follicles have less chance of maturing and ovulating.

70. Corpora lutea and experimental deciduomata in relation to mammary-gland growth and function. Warren O. Nelson, University of Chicago.

Continuous series of corpora lutea were produced in the ovaries of adult female rabbits by the intravenous injection of pregnancy urine at weekly intervals. Mammary glands were removed at representative intervals and studied for indications of glandular proliferation. Although some animals were maintained in pseudopregnant condition for 6 weeks, the glands did not reach the condition seen in normal pregnancy.

Other animals receiving weekly injections of pregnancy urine were subjected to deciduomata-producing stimuli. The presence of an experimentally induced maternal placenta in addition to a continuous series of corpora lutea did not cause mammary development beyond that seen in pseudopregnancy. Furthermore, surgical removal of the decidual tissue did not lead to the secretion of milk. Administration of an anterior pituitary extract in either the presence or absence of deciduomata did induce lactation.

Complete mammary proliferation is not produced either by active corpora lutea or by the presence of the maternal placenta as represented by experimentally induced deciduomata. Neither of these agents are responsible, directly at least, for the initiation of lactation, nor does milk secretion follow the removal of decidual tissue. It does depend upon the action of an anterior pituitary hormone.

71. The reciprocal hypophyseal-ovarian relationship in the control of mammary-gland development and function. Warren O. Nelson, University of Chicago.

Data from a number of experiments on the hormonal control of lactation have been interpreted as pointing to the existence of a reciprocal relationship between the ovaries and the anterior hypophysis in the control of mammary-gland development and function.

Adult non-pregnant females and castrated or experimental cryptorchid male guinea-pigs bearing functional ovarian grafts were employed in this study. The lactation response of males and females was similar in each of the following experiments: 1) Administration of anterior pituitary extracts induces lactation. 2) Removal of the ovaries (or ovarian graft) induces lactation. 3) Removal of the ovaries is not followed by lactation if oestrin is injected. 4) Removal of the ovaries is followed by lactation when anterior pituitary extract is injected in addition to oestrin.

On the basis of the foregoing and other related experiments, a hypothesis accounting for the development and function of the mammary glands has been developed. Glandular proliferation occurs through ovarian influences, particularly oestrin. Lactation does not occur during the growth phase, because oestrin inhibits secretion of the lactation-inducing hormone by the anterior hypophysis. When the oestrin influence is removed, secretion of the lactation-inducing hormone is permitted and lactation occurs. Administration of the pituitary hormone induces lactation in spite of the presence of oestrin, demonstrating that oestrin does not directly inhibit lactation, but operates through the hypophysis. The hypothesis here presented correlates under one common conception at least most of the facts relating to normal and experimentally induced lactation.

72. Implantation of pineal glands in the Leghorn fowl. A. W. Kozelka, University of Chicago. (Introduced by F. R. Lillie.)

Pineal bodies from embryo chicks in the latter stages of incubation and from day-old chicks were implanted subcutaneously into half-grown males and females. The number of implants received in any one experiment varied from 18 to 36 during periods varying from 47 to 59 days. In another series of experiments

pineal bodies from adult birds were implanted into 2 infant male chicks. One chick received 14 implants over a period of 28 days; the other, 25 implantations over a period of 44 days. The transplantations in both series of experiments were made for the most part between related individuals, many of which were full brothers and sisters.

The growth rate of the comb and the body weight of the birds receiving pineal implants differed in no perceptible way from their control brothers and sisters. These results are at variance with those of a number of investigators who report precocious and retarded development of secondary sexual structures and body weight as a result of pinealectomy and injection of extract of the pineal gland in domestic fowl and mammals.

73. The problem of hen feathering in Sebright cocks. L. V. Domm and T. F. Gallagher, University of Chicago.

Sebright males are normally hen feathered—a phenomenon provoking considerable speculation and experimentation. Morgan's castration experiments yielded typical male plumage. He therefore ascribed hen feathering to 'luteal cells' of testis—a theory later invalidated by Nonidez. Pezard maintained Sebright testes exert a feminizing influence on plumage of cock-feathered races as well as the Sebright. Roxas' cross-transplantations showed hen feathering to be genetically determined and a normal reaction of soma to testicular hormone. Benoit recently reopened the question by postulating a plumage-inhibiting hormone secreted by testes of all races, but presumably present above threshold of effectiveness only in hen-feathered races.

It seemed that the solution of this problem is provided by administration of male hormone. Technique employed consisted in plucking suitable areas and allowing plumage regeneration. After a 6- to 10-day period, injections are begun and continued over a 5-day period, following which feathers are allowed to mature.

The hormone had no effect on plumage of Leghorn capons, even when we injected the enormous dosage of 500 bird units of bull-testes extract in a 2-day period. An extract from 20 adult Sebright testes injected into a Leghorn capon yielded no plumage modifications.

Five Seright capons received 25 bird-units daily, over a 5-day period of bull-testes extract. All growing feathers reverted to female type during period of administration. Identical results were obtained from similar dosages of male hormone obtained from human male urine. Preliminary minimal dosage experiments seemingly indicate essentially similar thresholds for feather and comb response. Results therefore confirm Roxas' observations and invalidate Benoit's objections.

74. Durable vicarious action upon the development of thyroidectomized albino rats of thyroid from newborn rats implanted into the eye. Raoul M. May, College de France, Paris.

Working aseptically, under a binocular microscope, a thyroid lobe with its parathyroid was exposed in a rat born the same day, sucked up a glass pipette, and inflated into the anterior chamber of the eye of an albino rat 4 to 7 weeks

old. This operation was performed on 1 to 4 rats of the same sex and age. After a week, the thyroid and parathyroids of these rats were completely excised, and also the same organs of other rats of the same sex and age, nearly always of the same litter, unoperated control animals being set apart. The experiments were made on 15 litters or groups. The rats were raised 6 months.

The transplant from the newborn rat grew in its new environment and acquired the histological structure of an adult thyroid and parathyroid. Weighings made every month showed that the thyroidectomized rats bearing a graft developed similarly to the unoperated controls, while the rats which were merely thyroidectomized had a very incomplete development or died.

The newborn thyroid and parathyroid also reach their adult histological structure in the eye of non-thyroidectomized rats.

Thus, the thyroid and parathyroid of newborn rats, implanted into the eye of a young rat, grow as they would have done in situ, and assume the functions of the same tissues in the graft bearer if these are lost.

75. Distention of the oviduct in the fowl. L. V. Domm, University of Chicago.

In our sex studies on the Leghorn fowl we have encountered numerous cases in which the oviduct was distended to varying degrees with a clear watery fluid—a condition known as hydrosalpinx in the mammal. Cases were found in which the whole, or a portion, of the left oviduct of ovariotomized individuals was enormously distended. The same condition was revealed by the rudimentary right oviduct of such individuals. Instances were also found in which the left oviduct, as well as the rudimentary right, of the normal hen revealed the condition.

The condition was encountered in the left oviduct from 3 weeks to several years following ovariotomy regardless of the age at the time of operation. It was found in approximately 15 per cent of the cases in the left oviduct and in less than 1 per cent of the cases in the rudimentary right oviduct of ovariotomized individuals. Only 2 cases were found in which the left oviduct, and 3 in which the rudimentary right, of the normal hen revealed the condition.

The oviduct of the hen undergoes remarkable cyclic size changes in response to ovarian activity. It becomes large, glandular, and convoluted in preparation for the laying period, attains maximum size during this period, and undergoes a marked reduction subsequently. It likewise undergoes great reduction following ovariotomy.

It is believed that this anomaly is associated with degeneration or involution of the oviduct and that the fluid is a product of its glandular walls which is imprisoned due to absence of cephalic and caudal openings.

76. Differential distribution of water in the tissue along the long axis of Allolobophora caliginosus. J. William Buchanan and Mary Kopenhaver, Northwestern University.

Portions of the body, excluding nervous, alimentary, and reproductive systems, were cleaned, dried on filter-paper, and weighed, then dried over sulphuric acid and weighed repeatedly until the weights became constant. One set of experiments included pieces of 15 segments each from the extreme anterior end, the

middle, and the posterior end. In another set anterior, middle exclusive of the clitellum, and posterior thirds were used. The results showed a significant difference in the water content in the 3 regions, the differences being more than 30 times the probable error of the mean. With some individual exceptions, the average of 250 cases was: Anterior, 78.3 per cent water; middle, 80.6 per cent water; posterior, 85.4 per cent water. The relative water content of the posterior tissue was different from that determined by Hatai. When placed in distilled water 4 to 6 hours, anterior tissues gained weight, while middle and posterior tissues lost. In M/1000 potassium oxalate for the same period, all 3 gained weight, the anterior gaining most. In M/1000 calcium chloride the anterior gained slightly, but no appreciable change occurred in middle and posterior tissues. The results indicate a graded difference in water content of the body-wall tissue, chiefly muscle, being least in the anterior and increasing toward the posterior end. The order of water uptake in hypotonic environment is inverse to the order of water content. A calcium precipitant in hypotonic solution increases, and a calcium salt protects differentially against water appropriation.

77. The relationship between water content and oxygen consumption of certain fresh-water organisms. W. R. Duryee, Northwestern University. (Introduced by J. W. Buchanan.)

An attempt has been made to relate the rate of oxygen consumption to the water content of certain fresh-water animals, i.e., Amblystoma punctatum embryos, Planaria dorotocephala, Procotyla fluvialis, and Planaria maculata. Water content was controlled by non-toxic balanced electrolyte solutions having an osmotic pressure range from that of distilled water to that having a $\triangle = -0.648°C$. Quantity and rate of oxygen ultilization were studied by means of modified microrespirometers combined from the Thunberg and Novy types, which were sensitive to less than 3.1×10^{-4} cc. Over 74 experiments, each consisting of a 3-hour determination in tap water, followed by a similar period in the test medium, were checked and confirmed by 53 equivalent Winkler determinations. In relatively large volumes (500 cc.), distilled water depressed rate of oxygen consumption of Amblystoma embryos about 20 per cent and that of P. dorotocephala about 50 per cent. Smaller volumes of medium (1 cc. used in the respirometers) produced smaller changes. A modified Ringer's solution increased rate of oxygen uptake from 0 to 50 per cent depending on the degree of concentration of the Ringer's and the time of exposure. Procotyla had a wider range of tolerance to external osmotic changes than P. maculata. A 0.3 M dextrose solution had a negligible effect on body volume and respiratory rate of Amblystoma embryos, while electrolyte solutions produced effects comparable to those in planaria. Water content changes were checked by body-volume measurements and serial sections.

78. Experimental studies on fusion in hydra. Emma Johnstone Papenfuss, Johns Hopkins University. (Introduced by H. S. Jennings.)

In an investigation of the roles of the 3 layers, entoderm, mesogloea, and ectoderm, in the fusion of pieces of hydra, it was found that the entodermal layers

take the initiative in fusion, and that they fuse readily. If hydras are inverted, so that the entoderm is external, then placed in contact, the entodermal layers fuse rapidly, without irritation. This is true in both the green and the brown hydras. When the entodermal layers of the two diverse species are brought in contact (by inversion of both individuals), fusion occurs much more rapidly than in the usual attempts to fuse these two species. By observing in tissue culture, groups of entodermal cells, it appears that fusion is the result of the interlacing of amoeboid processes of these cells. Entoderm does not fuse with unirritated ectoderm; mesogloeal layers show little or no capacity for fusion together; and mesogloea does not fuse to unirritated ectoderm, nor to entoderm. Thus it appears that entoderm initiates fusion and controls the course of the process.

When a hydra is cut into pieces too small to regenerate, and these pieces are allowed to fuse, a normal hydra is synthesized from the pieces. Work is in progress to determine how such a hydra is formed, particularly with relation to the fate of differentiated parts, such as the basal disk, the hypostome, and the budding zone.

79. Regeneration in Corymorpha as affected by a thermal gradient. F. G. Gilchrist and L. K. Schmid, Claremont Colleges.

Naked stems of this hydroid (lacking 2 mm. at each end) regenerate either apicobasally (AB; i.e., with hydranth and stolon), biapically (AA), or monapically (AO). The hydranths may be large (A) or small (a). Thermal gradient treatment is either adjuvant or antagonistic to the intrinsic physiological gradient of the stem.

Adjuvant treatment retards or prevents regeneration at the lower end of the piece (Aa, AO); probably by bringing the upper end into control over the whole piece before the lower regeneration is under way. Antagonistic treatment assures lower end regeneration (AA, Aa, AB); presumably by withholding the control from the upper end until the lower regeneration is in progress. Brief antagonistic treatment (5 hours) tends toward heteropolar regeneration (AB, Aa). Apparently the lower end, influenced by control from the upper end after regeneration has begun but before a hydranth is laid down, develops a stolon (AB); influenced a little later, it develops a small hydranth (Aa). The latter is frequently incomplete; i.e., lacking more or less of the distal (sic) end. In extreme cases one proximal tentacle is developed. Long antagonistic treatment (24 hours) tends toward homopolar regeneration (AA or aa). Probably the control from the upper end is held back until the primordium of the lower hydranth is differentiated.

The importance of the time factor in hydroid regeneration is discussed.

80. Abnormal outgrowths induced in planarians by cautery. E. D. Goldsmith, Harvard University. (Introduced by H. W. Rand.)

A platinum electrocautery needle heated to a dull red was lightly applied for a fraction of a second to the middorsal postcephalic or postpharyngeal regions of selected individuals of Planaria maculata. In a number of cases the needle was dipped in paraffin prior to its application. The injured surfaces measured 0.3 to 0.5 mm. in diameter. In no case was the ventral wall affected.

Of 55 animals operated in the postcephalic region, 9 gave rise at the site of operation to small bulges, 4 of which developed into outgrowths which attained a maximum length of 2 mm. Three of the latter possessed a crescent-shaped pigment spot lying in an unpigmented area (eye?). In the fourth, a rodlike pigment spot alone was present. In the postpharyngeal group of 40 animals, 8 bulges resulted, 3 becoming outgrowths. Two of these were similar to the last-described above.

The induced growths exhibited movement which at times appeared to be autonomous. Notwithstanding, some 70 days after the operation, in all but 3 cases, they had reverted to their original condition, i.e., slight bulges. One of the 3 had what appeeared to be a typical left eye, and, at the end of 115 days, was active and in good condition.

The structure usually appeared tubular and, except in 2 instances where the distal ends were triangular, bore but slight resemblance to typical heads. They call to mind some of those described by Gebhardt ('26), resulting from homoiotransplants of regenerating planarian tissue.

81. Antennal regeneration in Daphnia magna. B. G. Anderson, Western Reserve University. (Introduced by the Secretary of the Society.)

The antennae of 150 female Daphnia magna were amputated at various levels during the early part of the first instar. Following injury, a portion of the remaining stump immediately proximal to the level of amputation turns brown. At the end of the instar this brown material is cast off. During the next instar the injured antenna corresponds closely to that part which was proximal to the brown portion during the instar of amputation.

The amount and type of regeneration, as measured during the instar in which the animals are primiparous, depends on the segment in which the level of the injury is located during the instar of amputation and on the level of the injury within that segment.

82. Regeneration in Phagocata gracilis. J. W. Buchanan, Northwestern University.

Cross pieces of Phagocata gracilis show: Pieces either form normal heads and undergo complete regulation or do not regenerate. Whether a certain body level regenerates a head or a posterior end depends on whether it constitutes the anterior or the posterior region of a piece. The total length of new tissue formed is the same in pieces of the same size regardless of the region of origin of the piece, but increases in proportion to old tissue as the size of the piece is reduced. The percentage of heads regenerated decreases sharply as pieces representing the same fraction of the whole are taken from more and more posterior regions. Head frequency also decreases as the size of the piece is reduced. The length of new tissue regenerated anteriorly increases as the level of origin of the piece becomes more posterior. The length of new tisssue regenerated posteriorly decreases as the level of origin becomes more posterior. In pieces of the same size the processes of growth and of differentiation are more rapid in anterior than in posterior pieces and more rapid at the anterior than at the posterior end of the piece. Distribution of a specific cell type does not determine

polarity nor the extent of new tissue formed. Whether or not regulation occurs depends on the relation between rate of growth and of differentiative metabolism of tissues adjacent to the anterior cut surface and that of other regions of the piece.

83. Regeneration of the lamina propria of anuran tympanic membrane. O. M. Helff, New York University.

R. palustris larvae in late metamorphic stages and following the completion of metamorphosis were taken and the integumentary portion of the tympanic membrane laid back to expose the lamina propria. The latter was then partially destroyed either by removing the lower half of the circular membrane or by removing all the membrane except a small amount tightly adherent to the outer rim of the annular tympanic cartilage. The integumentary flap was then replaced and the membranes later studied for regeneration.

Where one-half the membrane had been destroyed, complete regeneration usually ensued within 7 to 10 days. In general, the membranes were not as heavily pigmented as the normal membrane. Histological sections gave evidence of complete structural regeneration.

Series involving nearly complete destruction of the membrane generally showed complete regeneration, both macroscopic and histological, within one to two weeks. In some cases only approximately 75 per cent regeneration occurred, the central portions being absent. The membranes were frequently sparingly pigmented.

A third type of operation involved the extirpation of the annular tympanic cartilage, the destruction of the lamina propria, and the transplantation of the former beneath the membranous covering of the back musculature. Subsequent histological examination gave evidence that the lamina propria regenerated completely. The regenerated tissue, however, was derived from remnants of the original membrane attached to the cartilaginous ring, and not from the membranous muscle sheath above.

84. Rate of regeneration of partly histolyzed anuran tail skin. H. J. Clausen, New York University. (Introduced by O. M. Helff.)

Uniform-sized tail-skin grafts were secured from extreme anterior and posterior regions and from 2 intermediate areas and transplanted, autoplastically, to the backs of Rana pipiens larvae. Artificial metamorphosis was induced and the engrafted integument removed at certain stages of histolysis and transplanted, homeoplastically, to the back or tail of normal larvae. Following homeoplastic transplantations, anterior grafts invariably regenerated, histologically, with greater rapidity than posterior integumentary grafts. Intermediate tail-skin grafts regenerated at proportionate rates.

Control homeoplastic transplantations of skin from four regions of the tail, when grafted to the tail or back of normal larvae, clearly indicated that histolysis does not occur in larval tail skin following transplantation to normal individuals.

Histologically, the process of degeneration illustrates a definite, orderly sequence. Dissociation of various layers begins prior to the appearance of lymphocytes in the histolyzing area. Lymphocytes probably function chiefly as phagocytes.

The regenerative process is first evidenced, histologically, in the epidermal layers of the graft. The stratum compactum is shown to be the last layer of integument to completely regenerate.

It is concluded that an anterior-posterior gradient in regenerative rate is true for tail integument following partial histolysis. Apparently, differences in regenerative rate of integument at different levels of the tail are inherent qualities. Possible physiological factors associated with such differences, however, are still undetermined.

85. Regeneration of hind limbs in the vermilion-spotted newt, Triturus viridescens. H. H. Collins, University of Pittsburgh.

In the vermilion-spotted newt, Triturus viridescens, the males are easily distinguished from the females by the possession of several secondary sexual characters, the most obvious of which are the heavy black nuptial pads which appear during the breeding season, and the much larger hind limbs which characterize the males throughout the year. The fact that adults of this species have the power of regeneration suggested the possibility of determining whether this sex difference in the size of the hind limb would manifest itself in the regenerated limbs.

In a series of 9 males and 4 females which survived 13½ months after operation, the difference in size of the regenerated hind limbs was very marked and characteristic of the respective sexes. Regeneration was very slow and in no case were the limbs of normal length. The number and relative length of the digits was found to be normal, but the absolute length of the digits, while exhibiting wide individual variation was in no case more than ⅔ normal length. In general form and proportions the regenerated limbs also differed somewhat from the controls.

The appearance in the regenerated limbs of the size difference distinguishing the male from the female would seem to indicate the persistence in the adult of the growth-regulatory factors which were originally responsible for this size difference.

86. The effect of temperature on the scale form of regenerated lizard skin. G. K. Noble and H. T. Bradley, The American Museum of Natural History.

Many lizards regenerate tails having a simpler form and arrangement of scales than is found on the original appendages. Such scalation has been described as reverting to an ancestral type. In Tarentola mauritanica, where the difference between the scalations is extreme, physical factors appear to be primarily responsible for the discrepancy. If areas of skin of the same size are removed from the head, back, original and regenerated tails, the new scales regenerated at the same temperature have the same granular form, and are strikingly different from scales which develop over a whole tail bud on regeneration. When the tail bud is regenerated at 35°C., the scales are flat and smooth, with little corium. When the tails are regenerated at 28° C., the scales are thicker, slightly keeled, and set at an oblique angle to the axis of the tail.

Since the tails of the lizards reared at the higher temperature are longer and are growing faster at the time the scales first appear, the difference in the form of the scales regenerated at the different temperatures may be due to mechanical factors. On the back when areas of the same size are regenerating at different temperatures, the scales which are formed the most rapidly tend to be larger. No such differences in scale size appear on the tail buds regenerated at different temperatures.

87. Further observations on heteroplastic transplants of duck-kidney tissue. Carl J. Sandstrom, New York University. (Introduced by H. W. Stunkard.)

Heteroplastic transplants of intact kidney tissue from 9-, 13-, 19-, and 24-day duck embryos were made to the chorio-allantoic membrane of the 9-day chick. The grafts were removed at 24-hour intervals for a period of 9 to 11 days. The condition of the grafted tissue varied with the age of the donor, and the length of time on the host.

Grafts of the 9-day-donor series showed apparently normal tissue at all stages of removal. Those of the 13-day-donor series, when removed on or before the third day, showed small areas of necrotic tubules and a decisive infiltration of small lymphocytes. After the third day only normal tissue remained, and the lymphocytes had disappeared completely.

The same abnormal conditions as described above were found as late as the sixth day in the grafts of the 19- and 24-day-donor series. However, after the sixth day, the lymphocytes had disappeared, but in the former series necrotic tissue was found until the eighth day, and in the latter throughout the extent of the experiment.

The infiltration of small lymphocytes in the grafts is apparently due to the local inflammation of the host tissue during the incorporation of the foreign tissue. Its intensity and duration are probably dependent on the amount of fully differentiated kidney tissue present at the time of transplantation, and neither on the age of the host nor the genetic relationship between the host and the donor.

88. Heteroplastic transplantations of duck cartilage to the chorio-allantoic membrane of the chick. Carl J. Sandstrom and George L. Kauer, New York University. (Introduced by H. W. Stunkard.)

Heteroplastic transplants of cartilage from the humerus, femur, and tibio-tarsus of duck embryos varying in age from 6 to 20 days of incubation were made to the chorio-allantoic membrane of the 9-day chick. The grafts averaged 1 cu.mm., and were allowed to grow on the host for 9 days. Retransplants of some of the grafts were made so that the duration of the cartilage on the chick membrane varied from 9 to 27 days. Thus the total age of the donor tissue in the grafts varied from 15 to 47 days.

The cartilage persisted and grew on the membrane of the foreign host, and, in a number of grafts, bone and myeloid tissue were found, indicating normal differentiation of the heterotransplant. There was no indication of an infiltration of lymphocytes or invasion of connective tissue in any of the transplants,

but in most cases granulocytes were present within and about the tissue. Relatively little necrotic tissue was found. The results show that intact cartilage or bone tissue equivalent in age to a duckling 20 days after hatching incites no species specificity reaction from a chick host 18 days of incubation.

89. Skin grafts as indicators of interspecific relationships in urodeles of the genus Triturus. Russell L. Anderson, Johnson C. Smith University and University of Pittsburgh. (Introduced by H. H. Collins.)

In accordance with the work of Leo Loeb, who suggests that there exist in tissue certain auto-, homoio-, hetero-, and syngesio-substances which may bring about the introduction of corresponding toxins when a transplant is made, and that these injected toxins create a differential reaction as to fibroblastic invasion and leucocytic collection in the transplants by which a phylogenetic relationship may be ascertained, the writer has attempted to determine the relationship existing among various species of the genus Triturus by skin transplantations. Reciprocal grafts made on Triturus pyrrhogaster, Triturus torosus, Triturus viridescens, and Triturus dorsalis have indicated through various histological observations, made frequently over a period of 7 months, that Triturus torosus and Triturus pyrrhogaster are more closely related than either is to Triturus viridescens; that Triturus torosus and Triturus viridescens are more closely related than are Triturus pyrrhogaster and Triturus viridescens; that Triturus viridescens is more closely related to Triturus dorsalis than to Triturus pyrrhogaster or Triturus torosus. Transplants observed about 2 to 3 months after they had been placed gave the best results, for reactions resulting from injury and the like were well cleared away by that time and there remained chiefly the reaction between the host and the graft. Gross observations tended to verify the conclusions arrived at under histological examination.

In auto- and homoio-transplantations, made as controls, no cases have been found where the tissue of the transplant remained unchanged indefinitely. There have been changes in all grafts which indicate either a rearrangement or a complete destruction of the tissue.

90. Some reactions of an amphibian host, Triturus viridescens, against implanted mammalian tissues. Henry Idzkowsky, University of Pittsburgh. (Introduced by H. H. Collins.)

Macroscopic and microscopic examinations of transplanted adult rat thyroid tissue and of newborn rat shaft bones show that, due to the greater resistance to host defense reactions brought about by the compactness and composition of cartilage and bone cells, the method of elimination by the host of these tissues differs.

The characteristic connective-tissue infiltration which was observed in the replacement of necrotic thyroid tissue was not seen in the host's absorptive process of the necrotic cartilage and bone. The latter process was accomplished by the host's body fluid which acted as a solvent for the transplanted cartilage and bone tissues.

The implants became well vascularized shortly after introduction into the peritoneal cavity of the host. Thyroid tissue became necrotic within a few days after transplantation. The complete replacement of the destroyed thyroid tissue by host connective tissue extends over a period of from 2 to 2½ months. The cartilage and bone remain from 3 to 5 months before complete absorption takes place. In this connection the author noticed that the epiphyses of the transplanted shaft bones were resorbed last.

During this investigation it was also observed that those implants which had accidentally become attached to liver tissue were resorbed much more rapidly than those which did not establish this connection.

Although the transplants ranged from approximately 0.025 cc. to 0.040 cc. by volume, gross examinations revealed no detrimental changes to the host resulting from the physiological change surely produced by these foreign tissues.

91. Development and regression of dermal plicae following homoplastic and heteroplastic transplantation. O. M. Helff, New York University.

Heteroplastic transplantation of potential dermal plicae integument was made between larvae of 3 species to ascertain the possible development of dermal plicae structure during host metamorphosis. Results were as follows:

R. catesbeiana to R. palustris—slight development.

R. catesbeiana to R. clamitans—no development; grafts underwent considerable resorption.

R. palustris to R. catesbeiana—no development; slight resorption of grafts.

Homoplastic and heteroplastic transplantations of potential dermal plicae integument were made between larvae and newly metamorphosed adults to determine whether or not the stimulus for dermal plicae development is retained following involution. Results were as follows:

R. palustris to R. palustris—pronounced resorption of grafts in most cases: slight development in several cases where little resorption occurred.

R. catesbeiana to R. palustris—in general, pronounced development, especially of mucous and poison glands.

Homoplastic and heteroplastic transplantations of fully developed dermal plicae integument were made from newly metamorphosed frogs to non-metamorphosing larvae to determine the stability of dermal plicae structure or its possible regression. Abbreviated results were as follows:

R. palustris to R. palustris—no regression, typical structure maintained.

R. palustris to R. catesbeiana—very definite regression; no histological characteristics remaining in several cases.

In general, it may be concluded that development is hindered following heteroplastic transplantation from larva to larva, although the developmental stimulus is apparently present following involution of the host. R. palustris dermal plicae would appear to resist regression following homoplastic transplantation but are susceptible to regression following heteroplastic transplantation to non-involuting larvae.

92. Influence of annular tympanic cartilage on tympanic membrane formation following involution. O. M. Helff, New York University.

Previous work had shown that contact of the annular tympanic cartilage, during metamorphosis, with overlying integument induced transformation of the latter into tympanic membrane. Whether or not this influence persists following metamorphosis and whether or not maintenance of tympanic membrane structure is dependent on continued association with the cartilage was determined as follows:

Young R. palustris frogs were selected 2 to 3 weeks following complete metamorphosis. Integument including the tympanic membrane was removed and a similar piece of integument was removed from the back. Reciprocal transplantation of the 2 grafts was then made, autoplastically. Within 3 to 5 weeks definite though slight external signs of tympanic membrane formation were evident in the back-skin grafts over the annular tympanic cartilage. Histological examination showed slight to pronounced signs of membrane development. The membrane grafts made to the back showed only slight signs of regression, either macroscopic or histological.

Similar reciprocal transplantations were made on young R. clamitans frogs with somewhat similar results. Again only slight regression was observed in membranes transplanted to the back, while membrane formation in grafts over the annular tympanic cartilage varied from slight to very pronounced transformation.

The conclusion is reached that annular tympanic cartilage continues to exert its developmental influence on membrane formation for some time following metamorphosis, but with decreasing intensity. Also, that fully formed membrane is quite stable and not susceptible to serious regression when removed from contact with the annular tympanic cartilage.

93. Maintenance of an external nares in the anuran. O. M. Helff, New York University.

Artificial closure of the external nares of mature frogs is known to seriously affect the latter's respiration. The following experiments serve to explain how nares openings are maintained during larval life and throughout metamorphosis.

Integument was removed from the snouts of R. catesbeiana, R. clamitans, and R. pipiens tadpoles, exposing the cartilaginous rim of the external nares. Reciprocal, autoplastic transplantations were made between this integument and back skin. Perforations in the snout grafts on the back healed over, although in one series perforations persisted in association with portions of the cartilaginous rim transplanted through faulty technique. Normal nares formed in some back-skin grafts transplanted to the snout, while in others definite integumentary thinning occurred. Similar reciprocal transplantations were made on completely metamorphosed R. palustris larvae with like results, except that definite nares openings never developed in grafts placed over the nasal cartilage. Definite thinning of integument was evident, however.

The small, conical, cartilaginous rim of the external nares was removed from newly metamorphosed R. palustris frogs and transplanted, autoplastically, beneath back integument. The transplants remained healthy and became attached to the integument. Subsequent examination showed definite histological thinning of integument in contact with the transplants, although no perforations occurred.

It is concluded that the cartilaginous rim of the external nares is largely responsible for the persistence of the external nares integumentary opening during larval life, throughout metamorphosis, and immediately following involution.

94. Potential influences of the quadrate and suprascapula on tympanic membrane formation in the anuran. O. M. Helff, New York University.

The writer has previously shown that development of the integumentary portion of the tympanic membrane is the result of contact between integument and the annular tympanic cartilage. Whether or not other cartilages possess this influence was determined as follows:

The quadrate and annular tympanic cartilages were extirpated from newly metamorphosed R. palustris larvae and transplanted, autoplastically, beneath back integument. Subsequent coloration changes and 'outlining' of the integument (typical of tympanic-membrane formation) occurred, especially where contact with the transplants was strongest. Histological sections gave evidence of pronounced thinning and development of tympanic-membrane structure. Tympanic-membrane developments in integument over quadrate transplants were as marked as those in integument over annular tympanic cartilage transplants.

The suprascapula was extirpated and shaped into a ring 3 mm. in diameter with a 1½-mm. hole to approximate the form of the annular tympanic cartilage. The rings of cartilage were then transplanted, autoplastically, beneath back integument. Subsequent external signs of tympanic-membrane development were evident in only a few cases, corresponding with slight histological changes where regions of the transplant had established strong contact with the integument.

It is concluded that the quadrate possesses a potential developmental influence in relation to tympanic membrane formation similar to that of the annular tympanic cartilage. The suprascapula likewise probably possesses such an influence, but to a much less degree. Both cartilages, because of their anatomical isolation from integument, do not normally exercise this developmental influence.

95. The shedding of the horny teeth and mandibles of anuran larvae during metamorphosis. O. M. Helff, New York University.

Histological sections have been made and studied of the upper and lower jaws of R. catesbeiana and R. palustris larvae for 8 stages of metamorphosis. The histological conditions of the jaw tissues have been correlated with the various progressive stages of teeth and mandible shedding.

Series of autoplastic transplantations of the mandibles and the various rows of larval teeth, together with adjacent tissues of the jaws, have been made to the dorsal lymph spaces and the fate of the transplants subsequently studied. The results were quite varied. Shedding of teeth in the transplants may occur before, simultaneously with, or following the shedding process of teeth remaining in the jaws of the same animal. The shedding of the transplant teeth is, however, closely correlated with the histological condition of the associated tissues of the transplant.

It would appear that the shedding of larval teeth and mandibles during metamorphosis is not wholly the result of external abrasive factors, but due partially, at least, to degeneration and reorganization of various associated tissues of the jaw.

96. Differences in histolytic incidence of anuran tail integument. F. W. Dunihue, New York University. (Introduced by O. M. Helff.)

It had been previously shown by Clausen that anterior tail integument of anurans undergoes histolysis during larval involution before more posterior tail integument. Whether or not a similar difference in histolytic incidence exists between dorsal, ventral, and median integuments of the tail was determined as follows:

Rectangular pieces of integument were removed from the dorsal and ventral finny portions and from the intermediate median region at the same anterior-posterior level of the tail. They were then transplanted, autoplastically, to the back in various linear sequences. During metamorphosis of the larvae the incidence of histolysis and the amount of subsequent area reduction was determined at arbitrary intervals. Regardless of the position of the transplant on the back, median integumentary transplants invariably underwent histolysis, and hence area reduction first. Later, the onset of histolysis was observed in the ventral and dorsal integumentary grafts, the ventral grafts usually histolyzing first. The conclusion is reached that the integument of the median tail regions is definitely more susceptible to histolytic changes than is true of the more dorsal or ventral integuments. It also seems quite probable that the histolytic incidence of ventral tail integument is in advance of that of dorsal tail integument.

97. Anteroposterior cytolytic disintegration in Planaria dorotocephala. J. W. Buchanan, Northwestern University.

In distilled water Planaria dorotocephala disintegrate anteroposteriorly within 14 to 24 hours. In M/500 potassium oxalate this time is reduced to approximately 9 hours maximum. The accelerating action of M/2000 potassium oxalate is detectable. Animals live for 10 days without effect in distilled water plus M/40,000 calcium chloride. The protective action of M/500,000 calcium chloride is detectable. In M/100,000 calcium chloride posterior ends do not disintegrate during 5 days. Other chlorides protect against distilled-water disintegration; Ammonium<potassium<sodium<magnesium<calcium. Disintegrative action of distilled water is accelerated by 1 per cent alcohol; but if M/500 calcium chloride is added, a distinct protection is established. Animals die after several days in Ringer's solution, but do not disintegrate. If removed serially to well water, however, disintegration proceeds from anterior toward posterior, showing that the lethal effect of a hypertonic agent is from anterior toward posterior. The results indicate some sort of differential in the water-lipoid-calcium relation within the tissues from anterior toward posterior. The lethal effect of hypertonic solutions is from anterior toward posterior and is independent of cytolytic disintegration.

98. The toxic effects of copper sulphate and the protective action of colloidal dyes. Arthur Louis Schipper, State University of Iowa. (Introduced by J. H. Bodine.)

Paramecia in lethal solutions of copper sulphate subsequently exhibited swelling of the protoplasm, enlargement and inactivation of the contractile vacuoles.

The survival time was more than proportionately increased with the dilution of the copper sulphate.

Congo red and neutral red delay the lethal action of copper sulphate and the protective effect was changed with differences in the ratio of concentrations of colloidal dye and copper sulphate.

99. THE RELATIONSHIP BETWEEN SURFACE ACTIVITY OF HOMOLOGOUS CARBAMATES AND THEIR EFFECTS ON E. M. F. AND OXYGEN CONSUMPTION OF FROG SKIN. Edgar John Boell and A. B. Taylor, State University of Iowa. (Introduced by J. H. Bodine.)

In a previous report (Proc. Amer. Physiol. Soc., '32, Amer. J. Physiol., vol. 101, p. 10) the authors outlined a technique for measuring simultaneously the individual E. M. F.'s of a large number of frog skins. The method of treating the data obtained was presented, and a quantitative evaluation of the effects of homologous carbamates (methyl, ethyl, n-propyl, n-butyl, i-amyl, and phenyl) on E. M. F. was made.

The degree of depression of E. M. F. is proportional to the concentration of carbamate used, and also to the duration of its application. The activity of the members of the homologous series conforms to the rule of Traube, which states that the activity of the individuals of a series accords with the ratio $1\text{-}3\text{-}3^2\text{-}3^3$, etc.

The relative depression of E. M. F. by a carbamate parallels its action in lowering the surface tension of water. Stalagmometric measurements of the surface tension (air-water interface) were made at a temperature of $25° \pm 0.2°C$.

Measurements of the oxygen consumption of frog skin as influenced by carbamates were also made, using the differential manometer. A diminution of oxygen consumption was found to accompany a decrease in potential. The per cent reduction of E. M. F., however, is generally greater than the per cent reduction of oxygen consumption.

100. STIMULATION BY MINERAL ACIDS AND BY THE NORMAL ALIPHATIC ACIDS AT DIFFERENT HYDROGEN-ION CONCENTRATIONS IN THE BARNACLE. J. B. Allison, William H. Cole, and Irwin Sizer, Rutgers University.

Using the first 7 members of the normal aliphatic acid series, as well as hydrochloric, sulphuric, and nitric acids from 0.0002 to 0.002 molar, as stimulating agents, the per cent closure in a tripartite population of 222 animals was recorded at one-minute intervals until maximum closure occurred. Hydrogen-ion concentration varied from 0.32×10^7 to 58.89×10^7. By plotting per cent closure at the 4-minute interval against molar concentration or against pH a sigmoid relationship is revealed for all the acids, corresponding to theoretical demands, and showing that disturbances in ionic and molecular equilbria of sea water which initiate the stimulation processes are functions of the hydrogen-ion concentration. Plots of per cent closure against hydrogen-ion concentration confirm that relationship and demonstrate clearly that, at low concentrations of (H+), all 10 acids are equally effective, but that, as the (H+) increases, the higher fatty acids become increasingly more effective as stimulating agents. The carbon-chain effect becomes identifiable beginning with butyric acid and increases

progressively with valeric, caproic, and heptylic. Compared with the fatty acids at constant pH, it is demonstrated that, 1) the barnacle in general is about 10 times more sensitive to the changes produced by the free fatty acid than by the corresponding sodium salt; 2) the effect of introducing CH_2 groups is more pronounced among the lower acids than the higher at constant pH, but becomes effective only in the higher acids when the pH varies.

101. Stimulation in the barnacle and the killifish by the di-carboxylic acids. Irwin Sizer, Rutgers University. (Introduced by William H. Cole.)

A study of chemical stimulation by the first 5 normal aliphatic di-carboxylic acids was made on the barnacle (Balanus balanoides) and the killifish (Fundulus heteroclitus) in sea water. With the barnacle some factor related to the hydrogen-ion concentration (possibly the CO_2 tension, or the hydrogen ion itself) is clearly the stimulating agent. Within the limits of the concentrations used, there seems to be a sigmoid relationship between stimulating efficiency and pH. No stimulation caused by the length of the carbon chain was demonstrated, for adipic acid with 6 carbon atoms in its chain proved to be no more stimulating, at equal hydrogen-ion concentrations, than oxalic acid with only 2 carbon atoms.

A carbon-chain effect was clearly demonstrated in Fundulus, however. When solutions of equal hydrogen-ion concentration were used, the reaction time of the fish became shorter as the length of the carbon chain of the stimulating agent was increased. For Fundulus there are 2 stimulating agents, one related to the hydrogen-ion concentration, and the other related to the length of the carbon chain. In more dilute solutions, stimulation seems to be determined chiefly by a factor related to the hydrogen-ion concentration, while in solutions of higher concentrations the carbon chain predominates in bringing about the change in interfacial phenomena resulting in stimulation. Thus, in the more dilute solutions, there is little difference in stimulating efficiency between solutions of the different acids at the same pH, but in solutions of higher concentration at the same pH, the difference is marked, due to the carbon-chain effect.

Balanus balanoides is more sensitive to changes in hydrogen-ion concentration than Fundulus, while Fundulus is much more sensitive to changes in the length of the carbon chain.

102. Stimulation by sodium and potassium salts in Balanus balanoides. J. B. Allison and William H. Cole, Rutgers University.

Solutions of sodium chloride, sodium nitrate, sodium sulphate from 0.02 to 0.15 N; potassium chloride, potassium nitrate, and potassium sulphate from 0.0006 to 0.032N have been tested as stimulating agents on the rock barnacle, B. balanoides, at constant temperature and pH. At the higher concentrations of all the salts, closure of the valves is induced, and the per cent closure in each population decreases with concentration according to a complex relationship. At lower concentrations the opposite effect, or opening of the valves, is produced and the per cent opening increases to a maximum and then decreases as the concentration decreases. The type of effect, therefore, depends upon the concentration used. The order of effectiveness expressed by normal concentration

is as follows: $KNO_3 > KCL > K_2SO_4 > NaCl > Na_2SO_4 > NaNO_3$. Potassium salts are on the average 5 times more effective than sodium salts. The order of effectiveness among the sodium salts is different than among the potassium salts: nitrate being most effective when combined with potassium, but least effective when combined with sodium; sulphate is least effective with potassium, but intermediate with sodium; chloride is intermediate with potassium, but most effective with sodium.

103. Stimulation in Fundulus by hydrochloric and by fatty acids at different hydrogen-ion concentrations in sea water. J. B. Allison and William H. Cole, Rutgers University.

Hydrochloric acid and the first 7 members of the normal aliphatic acid series have been tested as stimulating agents on Fundulus heteroclitus in a sea-water environment at constant temperature. The pH of the solutions varied from 3.1 to 7.0. The reaction time for all the acids decreases with increasing hydrogen-ion concentration according to a symmetrical curvilinear relationship. Hydrochloric and formic acids appear to be equally effective, but beginning with acetic acid stimulating efficiency increases as each CH_2 group is added to the molecule, except that heptylic acid lies intermediate between valeric and caproic acids. Evidently the Fundulus is less susceptible to the disturbances in the environment occasioned by increasing the hydrogen-ion concentration than is the barnacle, and thus reveals a progressive increase in sensitivity to each added CH_2 group even among the lower members of the series.

104. Differences in electrical potential between various levels of the tail of anuran larvae. O. M. Helff, New York University.

Previous work had shown that anterior tail integument and muscle undergo histolysis before more posterior integument and muscle. Also, that partly histolyzed anterior tail integument exhibits a higher rate of regeneration than posterior tail integument. These histolytic and regenerative gradients probably have a physiological basis, such as differences in metabolic rate. As an indication of possible metabolic differences, the following electrical potential tests have been made:

Two squares of integument were removed from the tails of large R. catesbeiana larvae, as far separated anteriorly posteriorly as possible, to expose the underlying musculature. Possible differences in electrical potential between these 2 muscular regions were then determined. The anterior muscle invariably proved to be electronegative compared with the posterior muscle, the average difference of 10 cases being approximately 7 millivolts. Intermediate muscle regions gave proportionate millivolt differences, the anterior muscle always being electronegative. Similar tests were run on larvae in a much earlier developmental stage, the anterior muscle showing an average negative potential of 5.3 millivolts when compared with posterior muscle. Cutting of the dorsal nerve cord did not effect the potential differences. Strips of tail integument showed no differences in potential between their extremities when removed from the animal, but definite differences when tested 'in vivo.'

The results are indicative of differences in metabolic rate between various anteroposterior levels of the tail. Suitable oxygen consumption and carbon-dioxide production tests are now in progress to verify such metabolic differences.

105. Electro-endosmose in Tradescantia epidermis. Gordon Marsh, State University of Iowa. (Introduced by J. H. Bodine.)

When an electric current of sufficient strength is sent through cells of Tradescantia epidermis the protoplast retracts from the cellulose wall. Retraction usually, but not always, occurs at the anode end of the cell, and may be made to appear at the opposite end on reversing the current. With weak currents recovery may occur when the circuit is opened. The phenomenon is electro-endosmotic in nature, since:

1. Retraction always occurs along the axis of current flow.
2. The time for visible retraction is inversely related to the current strength.
3. The occurrence of retraction is independent of the osmotic pressure of the external medium.
4. Permeability changes induced by the current can offer no explanation.

The volume decrease of a cell shows that the electro-endosmotic outward flow of water is greater than the inward flow. Since the current passing into and out of the cell is the same, evidently the electrokinetic potential at the plasma membrane is different at the anode and cathode ends. It is concluded that the current confers a charge upon the membrane which is opposite in sign for opposite ends of the cell. This is of interest not only from the point of view of the plasma membrane as a cellular electrode, but also because of a possible relationship between the electrokinetic and the thermodynamic potential.

106. Relation between current density, time, and response of Amoeba proteus to electricity. William F. Hahnert, Johns Hopkins University. (Introduced by S. O. Mast.)

An amoeba moving toward the anode responds to sudden make of a galvanic current by reversal of protoplasmic flow in the posterior end. The time from the closing of the circuit until response occurs, the reaction time, varies nearly inversely with the square of the current density.

The reaction time is composed of 2 parts: a stimulation period, the time during which passage of current is necessary and a latent period, the time during which passage of current is not necessary in order to obtain a response. At any given intensity, the reaction time is constant regardless of the duration of the stimulus. Both the reaction time and the stimulation period decrease as the current density increases, whereas the quantity of current passed (intensity times the duration) and the latent period remain constant.

Microscopic observations and the experimental results obtained indicate that the response consists essentially in solation of the plasmagel on the cathodal side of the organism.

107. Reactions to electricity in Spirostomum ambiguum. William F. Hahnert, University of Pennsylvania. (Introduced by S. O. Mast.)

Specimens of Spirostomum ambiguum contract sharply when a galvanic current of suitable strength is passed through a solution containing them. This response appears to be of an 'all or none' character and has a very short reaction time. The strength of the current required to provoke contraction depends upon the

orientation of the organism, being least when it is moving toward the cathode, more when it is moving toward the anode, and most when it is moving across the current. This variation in excitability seems to be increased in certain salt solutions.

The effect of various combinations of intensity and duration of stimulus was studied. At any given duration, the percentage of trials yielding response increases as the intensity of the stimulus increases and at any given intensity, the percentage of trials yielding response decreases as the duration of the stimulus decreases. The quantity of current required to provoke response (intensity times duration) is not constant as in Amoeba, but decreases as the current intensity increases.

108. Relation between locomotion and frequency of contraction of the contractile vacuole in Paramecium caudatum. John A. Frisch, Loyola College and Johns Hopkins University (Introduced by S. O. Mast.)

Paramecia and unicellular algae were sealed with vaselin in an enclosure under a cover glass to establish a balanced aquarium. The paramecia survived for over a month and died ultimately of starvation. Single individuals were observed during 50 to 100 consecutive pulsations of the contractile vacuole. The frequency varied from 15 seconds to 6 minutes and 5 seconds. Most of the long intervals occurred while the animals were actively swimming, and most of the short ones while they were at rest.

Paramecium does not feed while actively swimming and thus ingests less water than it does while it is at rest. The frequency of pulsation, therefore, appears to be directly correlated with the rate at which water is taken in. If this is true, it strongly supports the contention that the primary function of the contractile vacuole is to regulate the water content of the protoplasm.

109. The influence of the central nervous system on response to light in the earthworm, Eisenia foetida. C. Ladd Prosser, Johns Hopkins University. (Introduced by S. O. Mast.)

Eisenia foetida is photonegative in high and moderate intensities and photopositive in low intensities. Removal of the brain raises the intensity to which Eisenia responds positively. Separation of the 2 lobes of the brain or removal of one lobe has approximately the same effect as removal of the entire brain. Transection of one pharyngeal commissure is followed by increase in positive responses to stimulation on the unoperated side, but not to stimulation on the operated side. If the transverse commissure of the brain is cut or cauterized in any region, normal negative responses persist if more than one-third of the fibers remain.

Negative response can be increased by subjection to high temperatures and by injection over the brain of strychnine sulphate or dilute cocain HCl. Negative responses can be decreased by subjection to low temperatures and injection over the brain of benzyl alcohol, nicotine, nicotine tartrate, or concentrated cocain HCl.

These results indicate that the ventral-nerve cord induces positive responses to light, but that stronger impulses cross from one side of the brain to the other, stimulating contralateral muscles and thus inducing negative responses, and that interference with the activity of the transverse commissure in the brain alters the responses to light.

110. Conditioned behavior of isolated and grouped cockroaches on a simple maze. Mary Frances Gates and W. C. Allee, University of Chicago.

Cockroaches (Periplaneta americana) can be conditioned to run a simple maze when isolated or paired or present in groups of 3, provided a sufficient number of trials are given on the same day. The learning curve given is of the diminishing saw-tooth variety rather than smooth. Great individuality exists in cockroaches. Some could not be maze conditioned by the methods used, and in all instances it was necessary to know the maze behavior of the individual cockroach when isolated in order to interpret its behavior when paired or a member of a group of 3. An isolated roach can be conditioned with less time and with fewer errors per trial than when paired or a member of a group of 3. In the 2 latter cases, activity and accordingly the number of errors per minute are less than when the roaches are isolated on the maze. Under the conditions of the experiments, both time and errors per trial are decreased when the interval between exposure on the maze is brief, but there is little or no evidence of retention of the effects of maze conditioning from day to day. The evidence at hand indicates that the maze behavior of these animals is affected by the conditioning of the organism as a whole as well as by the possible or even probable conditioning of the nervous system.

111. Studies in population physiology. II. Factors regulating initial growth of Tribolium confusum populations. Thomas Park, University of Chicago. (Introduced by W. C. Allee.)

The observation that certain initial intermediate-sized populations of Tribolium confusum produce more eggs and larvae per female day at early periods than do the minimal-sized groups has been demonstrated by several investigators. An explanation of this situation is advanced in which the results are shown to be due to the interaction of 2 antagonistic factors. The first factor, cannibalism or egg eating by adult beetles, is most extreme in concentrated populations and lowers egg numbers therein. This situation favors maximum egg production in smaller populations. The second factor, based on the proved fact that copulation and successive recopulations stimulate females to produce fertile eggs, favors greatest productivity in more dense cultures due to the greater opportunities existing there for successful meetings of males and females. An interaction of these 2 factors results in an intermediate optimal population in which females produce significantly more fertile eggs than do females of smaller or larger groups. This phenomenon is related to the field of animal aggregations or mass physiology.

112. Studies in animal aggregations. Further analysis of the protective value of biologically conditioned fresh water for the marine turbellarian, Procerodes. W. C. Allee, Marine Biological Laboratory and University of Chicago.

Previous experiments concerning the action of hypotonic water extracts of other Procerodes and Planaria maculata culture water on the marine Procerodes wheatlandi isolated therein are confirmed. Adsorption on charcoal or an egg

albumen does not significantly affect the protection furnished by planarian culture medium. No protection is furnished by egg albumen, gum arabic, or mucus made by dissolving dried parotid gland in water. Previous work had shown the same situation with gelatin. Ethyl urethane, a depressant, does not cause protection; it acts in this respect as had ethyl alcohol in previous experiments. Water solutions or suspensions made from ether-soluble and ether-insoluble fractions of Procerodes extracts exhibit less protection than does the whole water extract. Cane-sugar solutions definitely confer protection in all concentrations tried from M/1 to M/33⅓. Solutions of M/40 and M/50 gave the same survival as did the non-sugar controls. The protection conferred in these experiments by M/25 and M/33⅓ solutions was approximately that given in accompanying isolations into planarian culture water. The P. maculata culture water did not possess osmotic pressure beyond that furnished by electrolytes, and these were balanced with those in the controls in all this series of experiments in so far as that can be done by testing their electrical conductivity.

EMBRYOLOGY

Read

113. Age of human embryos. George L. Streeter, Carnegie Institution of Washington. (Lantern; 12 min.)

The determination of age of early human embryos has been arrived at in the past by inadequate clinical data and, therefore, there has resulted large discrepancies in age estimates. The macaque, having a similar type of implantation and a similar growth curve, provides a new means of making age determinations. Checked in this manner, it will be shown that the well-known Peters' human embryo is 13 days old, fertilization age. At 20 days the macaque embryo has a Hensen's node and notochordal process and the primitive streak is well marked. At 23 days there are 3 paired somites, and at 29 days the embryo is 7 mm. long. At 35 days it corresponds to the human embryo of 12 to 14 mm., the only noticeable difference in form, as compared with the human, being the possession of a longer tail.

114. Embryology of the skimmer (Rynchops nigra). I. The early developmental stages. Alice L. Brown, Emma Vandergrift, and Mary Rowland Watts, Brenau College. (Introduced by Secretary of Section F.) (Lantern; 10 min.)

During our marine studies along the Georgia coast the past 2 summers, one of our shore birds (Rynchops nigra), much in evidence for his individuality, though gregarious in his habits, has come under observation. Two summers ago, in the vicinity of St. Simons and Sea Island on Pelican banks, the adults and their nesting habits were observed, and again the past summer at St. Marys, and a series of photographs secured.

Last summer, after acquiring information from the Natural History Museum, the National Audubon Society, and the Smithsonian Institution that the field of embryology on the skimmer was open, 200 embryos were collected from the late-

cleavage and gastrulation stages through to hatching. The eggs were collected from marked nests, and series from each nest in other cases. They were taken to the laboratory where the embryos were removed and fixed in Tellyesnicky's fluid. Some older embryos were fixed in 10 per cent formalin for later gross examinations.

After photographing these younger stages, they have been stained in alum-cochineal, cleared, and mounted in neutral gum damar for study and demonstrations. Other embryos of critical developmental stages are in the process of sectioning and staining for cell study and comparative studies with the chick.

(Illustrated by film slides of the adult bird characteristics and nesting habits, followed by a series of developmental stages and comparative studies.)

115. The reproductive cycles of some cave bats. Mary J. Guthrie, University of Missouri. (10 min.)

From the examination of the ovaries and reproductive tracts of over 600 female bats representing 6 species, a tentative seriation of events in the reproductive cycle is made. Copulation occurs in the autumn and is not conditioned by the presence of large follicles. An infiltration of leucocytes into the tubes is coincident with insemination, and the females hibernate with their tracts filled with sperm and leucocytes. Whenever the bats become active in the laboratory or normally as at the close of the hibernation period, some of the sperm are phagocytized by the leucocytes, and the entire contents of the tract are eliminated through the vagina. Insemination normally occurs in the spring as the bats leave the caves, and ovulation follows. Insemination may, also, occur after unseasonal weather conditions have aroused the bats; but they reenter a hibernating state, and ovulation does not ensue. The species observed were Myotis lucifugus lucifugus, M. sodalis, M. keenii septentrionalis, M. grisescens, Pipistrellus subflavus subflavus, and Eptesicus fuscus fuscus. For each specimen, data are available regarding the age; condition of fat; size of follicles in the ovaries; height of the mucosa; size, movements, and contents of the tubes; size, movement, and contents of the uterus; and size and contents of the vagina. Active sperm are found in the uterine horns of the female bats throughout the winter, but there is no evidence that sperm of the autumn copulations activate the eggs in the spring.

116. Culture 'in vitro' and transplantation of young rabbit embryos. A. J. Waterman, Brooklyn College. (Introduced by Leigh Hoadley.) (10 min.)

Young rabbit embryos of the late primitive-streak and 2-somite stages, when cultured 'in vitro' upon the surface of plasma clots for 2 to 5 days, develop into embryos with 6 to 9 pairs of somites and paired heart primordia. The culture medium consisted of adult chicken plasma plus a saline extract of either chick or rat embryo. Preliminary exposure to a low temperature does not apparently effect differentiation. Portions of the 2-somite stage differentiate independently, or, if transplanted between the epiblast and entoderm of chick embryos of the primitive-streak stage, they are incorporated as grafts, and differentiation occurs.

Explants of circular embryonic discs differentiate either as thin sheets or thickened masses of tissue; preprimitive-streak stages give a thickened mass of tissue in which 1 to 3 pulsating vesicles may appear; while the early primitive-streak stages give embryos with 1 to 5 pairs of somites.

Cultures of 6- to 7-day blastocysts give similar results. The circular embryonic disc elongates, a primitive streak appears, the blastocyst increases in diameter, but differentiation goes no further. The preprimitive-streak stage gives a primitive streak, general thickening of the embryonic disc, and frequently a pulsating vesicle. Subculturing resulted in fatal injury in all cases.

Transplants of whole blastocysts and isolated embryonic discs have been made to the omental bursae of adult rabbits, to the embryonic membranes enclosing the embryo 'in utero,' and to pseudopregnant and pregnant uteri.

117. Cytoplasmic localization in the unsegmented egg of the newt, Triturus viridescens, as shown by the development of egg fragments. G. Fankhauser, Princeton University. (Lantern; 7 min.)

Fertilized unsegmented eggs of Triturus viridescens were constricted by means of a hair loop.

a. In partially constricted eggs, the cleavage begins in the part containing the fusion nucleus. After 2 or more divisions, one of the resulting nuclei migrates across the bridge connecting the 2 parts and calls forth a much-delayed, but normal, segmentation of the other half. These eggs develop into double monsters of various types or into completely separate twins, as do partially constricted eggs of the European newt (Spemann). However, one or both of the twins may exhibit typical unilateral or cyclopic defects which indicate that the bilateral symmetry is established in the unsegmented egg. The fate of the egg halves would depend on the angle between the plane of constriction and the—invisible—median plane of the future embryo.

b. If the 2 parts of the egg are separated completely, the one containing the fusion nucleus segments normally. In some cases development does not proceed beyond the gastrula stage and gives rise to a 'ventral embryo' without axial organs. The potency to form an embryonic axis is, therefore, already localized on the future dorsal side of the embryo, in a region which corresponds to Spemann's organization center.

The results confirm those obtained on the egg of the European newt. The organization center is present in the unsegmented egg shortly after fertilization; the fate of any egg fragment depends primarily upon the amount of organizator material which is allotted to the fragment, i.e., upon cytoplasmic factors.

118. The role of the chromosomes in the early development of merogonic embryos in Triturus viridescens. G. Fankhauser, Princeton University. (Lantern; 7 min.)

Fertilization in urodeles is normally polyspermic. If the egg is constricted into 2 completely separate parts, the one without the egg nucleus may contain one or several sperm nuclei ('merogonic' fragment). In the case of the European newt, such fragments may give rise to merogonic larvae. In Triturus viridescens, merogonic fragments undergo normal or, more frequently, abnormal cleavage. However, not a single merogonic embryo has so far been reared successfully through gastrulation.

A cytological study of cleavage stages showed that the diploid number of chromosomes in Triturus viridescens is 22, the haploid number 11. Most of the merogonic embryos preserved in the critical stage of development (just before or early during gastrulation) contained, however, various deviating numbers, ranging from 3 to over 40, in most or all of the mitotic figures.

These observations indicate that abnormal combinations of chromosomes, resulting from multipolar mitoses in early cleavage stages, are the main cause of the early cessation of development in all merogonic embryos. The presence of a balanced set of chromosomes, therefore, seems to be necessary at the beginning of gastrulation to make normal development possible. This conclusion would confirm the view expressed by Boveri and other workers that the hereditary factors located in the chromosomes begin to play an important role in development at the time of gastrulation.

119. The organization and proliferation of nervous tissues in rat embryos developing upon the chick chorio-allantois. J. S. Nicholas and D. Rudnick, Yale University. (Lantern; 15 min.)

Rat embryos from 5 to 12 days of age have been transplanted to the chorio-allantois and their development as grafts studied at intervals from 48 hours to 8 days. The embryos were transplanted, 1) with all membranes intact; 2) with amnion alone, and, 3) devoid of coverings.

No grafts were obtained from transplantations of embryos younger than 8½ days. The percentage of successful cases rises from 3 per cent at this stage to 17 per cent at the close of the eleventh day. Sections show general differentiation comparable to that occurring in an equal period of normal development. Transplants made subsequent to the eleventh day show survival only, not differentiation.

The nervous system, which is extremely active in normal development during this period, maintains the same proportionate rate of development in its new surroundings. Even when transplantation is performed before definitive form is assumed, organization proceeds in a regular and identifiable manner. Olfactory lobes, cerebral hemispheres, optic evaginations, otic vesicles, and hypophysis, together with parts of the brain stem, are clearly distinguishable.

The spinal-ganglion cells and peripheral-nerve trunks wander through the mesenchyme of graft and host. The ganglia are not compact. Cells of the neural crest have been traced into the forming meninges as well as into regions of the ganglia. The nervous tissues tend to overproliferate when released from their normal restraints.

120. In vitro ossification of cranial primordia from the rat. Margaret R. Murray, Columbia University. (Lantern; 15 min.)

In the rat, ossification normally occurs in the frontal and parietal bones at 17 days of gestation. In tissue cultures of these bones from 14- to 16-day embryos, centers of organization and calcium deposition appear 2 to 4 days after explantation and develop for a week or 10 days. Staining with aniline dyes picks out a characteristic ground substance within which branching cells are

included. Osteogenic fibers may be seen under certain conditions, and the trabeculae and periosteal formations of spongy bone are the rule. Alizarin staining of whole mounts indicates sharp and definite concentration and fixation of calcium salts in these ossification centers, although no means of circulation except general diffusion through the plasma clot is provided under the growth conditions. The medium consists of adult plasma, embryonic extract made from litter mates, and Tyrode's saline solution. Explants made under the same conditions from the ossified frontal bones of later embryos (18 to 20 days) produce only fibroblasts.

121. AN IRRADIATION METHOD FOR DETECTING FACTORS IN NORMAL DEVELOPMENT. P. S. Henshaw, Memorial Hospital, New York City. (Lantern; 15 min.)

Radiation, such as x-rays, may be used to detect and study factors involved in normal development. It has certain unique characteristics, as an effecting agent, which make possible the quantitative expression of relative effective 'dosages.' Nearly all work thus far, which has employed an external agent in developmental studies, has been based on changes produced by the agent without reference to how much of it was used in each case. Radiation, because it can be measured, offers an opportunity to compare effects caused by different amounts of an agent and to determine how much of it is required to produce certain effects in organisms under different conditions or at different ages. Two experiments will be described to show how radiation may be used to study factors regulating the rate of cell division and structural expression. The first deals with Drosophila eggs, which show sharp and extensive changes in radiosensitivity during early development, and the second deals with Arbacia eggs, which, when irradiated before fertilization, are delayed in development. The latter effect is produced as a function of the amount of radiation administered and lost as a function of time (recovery), apparently exponentially.

By demonstration

122. THE CORTEX OF THE ARBACIA EGG DURING SEGMENTATION. Illustrated with motion-picture film. Robert Chambers and C. G. Grand, New York University.

Freshly fertilized Arbacia eggs were denuded of their fertilization membranes, washed, and kept in a solution of KCl and Na oxalate (isotonic with sea water) to prevent the formation of the relatively tough hyaline plasma membrane which is a precipitation product when calcium is present of a substance secreted by the egg. Na oxalate was added to KCl to eliminate all possible traces of Ca in the medium surrounding the eggs. Normal segmentation in the usual time occurred when the eggs were placed in the solution within 10 minutes after fertilization.

With all extraneous membranes removed, the fertilized eggs were found to be about as plastic as unfertilized eggs. They could be stretched into long strands with microneedles, and be divided into pieces which quickly rounded up. The operation must be very carefully done to prevent disintegration.

The mitotic elongation of the naked egg is considerable and the forming furrow has widely receding walls. During this period the cortex can be more easily

broken at the 2 opposite poles than elsewhere. Tearing the cortex produces an ever-widening gap through which the more fluid interior gushes out. The resulting diminution in volume of the dividing egg does not affect its general shape until the shrinking and thickening cortex finally collapses and undergoes cytolysis. This indicates that the cortex of the dividing egg is a semi-elastic coat under tension and of sufficient stiffness to play an important part in retaining the shape of the egg during its cleavage.

123. Normal table of the development of the guinea-pig from 11 days to 35 days, copulation age. Mary T. Harman and Marjorie Prickett Dobrovolny, Kansas State College.

Specimens, photographs and drawings, and short descriptions, particularly of the external form will be given for developmental periods from 11 days to 35 days, inclusive. The age has always been calculated from the time of copulation until the time of securing the embryos.

By title

124. New experiments on sex in parabiotic twins of Amblystoma maculatum Shaw. Emil Witschi, State University of Iowa.

A year ago it was reported that in heterosexual pairs of parabiotic twins of the spotted salamander, the male interferes with the normal development of the ovaries of its co-twin, producing complete sterilization (freemartin effect) in most cases. This result was obtained from material collected in the vicinity of New Haven, Connecticut. This year the experiment has been repeated with the same species from the Ozark Mountains (Arkansas). This local race is characterized by pronounced hermaphrodite tendencies. In heterosexual parabiotic twins of this race the gonads of the female mate develop almost normally (no freemartin effect in this case). Evidently sex antagonism is low in forms that constitutionally are inclined toward hermaphrodism.

125. The non-specificity of anuran hypophyses in the induction of ovulation in toads. Irvin A. Wills, Gardner M. Riley, and Esther M. Stubbs, State University of Iowa. (Introduced by E. Witschi.)

Successful ovulation was secured in two Bufo americanus females given daily implants of 4 frog hypophyses into the dorsal lymph sac. The donors were Rana sphenocephala and Rana pipiens. In both toads complete ovulation and egg laying occurred on the third day, one having received 8 hypophyses, while the other received 12. The eggs obtained were normal in every respect. Female toads given daily homoplastic implants of 2 hypophyses ovulate within 2 to 4 days. Control females not receiving implants have not ovulated even after several weeks.

Previous investigators have been successful in inducing ovulation in frogs by implants of toad hypophyses, but have failed in the attempt to cause ovulation in toads with frog implants. Our experiments make it clear now that the hypophysis hormone (anterior lobe) controlling ovulation in anurans is entirely non-specific. The failure of other workers to secure ovulation in toads by heteroplastic implants was probably due to improper physiological conditions in the animals used in their experiments.

126. Control of the sex characters in the English sparrow, Passer domesticus (Linnaeus). Warren N. Keck, University of Iowa. (Introduced by E. Witschi.)

The effects of castration were studied on 52 male sparrows. Regenerated feathers in areas showing sexual dimorphism were always of the male type. The capon retains the normal male plumage. The bill of the adult male is blue-black in color during the breeding season. When such a male is castrated, the color of the bill changes to a light horn-brown within 5 weeks following the operation.

Daily intramuscular injections of female sex hormone were given 12 capons for a period of 30 days. As much as 40 rat units per 100 grams of body weight did not influence regenerating feathers toward femaleness.

In the female complete sinistral ovariotomy failed to produce any effect upon regenerating feathers. The new feathers were invariably of the normal female type. Postmortem examination revealed no compensatory growth on either the right or left gonadic site. In all cases the oviduct was small and immature in appearance.

Subcutaneous and intra-abdominal testis implants on poulards did not produce any modification toward male feathering.

Daily injection of female sex hormone for a period of 9 days produced hypertrophy of oviducts in immature female birds. The oviducts of test individuals averaged 33 per cent heavier than those of controls.

127. Activity of the peritoneal (germinal) epithelium of the testis of the musk turtle (Sternotherus odoratus L.). Paul L. Risley, State University of Iowa. (Introduced by E. Witschi.)

Histological examinations of testes of both immature and mature individuals of the musk turtle show that the peritoneal epithelium does not give up its proliferative capacities with the embryonic differentiation of the testis. Certain regions of the antimesorchial surface retain their activity and continue to contribute elements to the inner part of the testis during its growth periods. Germ cells remain in these active areas when the epithelium becomes reduced to a single layer of cells at the end of testis differentiation. Cords of cells grow inward and contribute to the growth of the seminiferous tubules. In this form, the proliferations of the germinal epithelium of the testis are similar to and homologous with the continuous proliferations of the germinal epithelium of the ovary.

In Sternotherus, both testis and ovary differentiate out of a bisexual primordium in which the deeper parts of the germinal epithelium form an ovarian cortex. Since the surface epithelium persists as an active part of both ovary and testis, it must be subject to the same physiological factors of female or male differentiation, respectively. Once the direction of sex differentiation is established, the male or female character of the germinal epithelium is determined. Its activity is then in the direction of one or the other sex and is directly dependent upon the processes of embryonic sex differentiation and determination.

Further evidences on the problems of germ-cell origin and of testis-ova are presented and discussed.

128. Reconstruction in the nervous system following unilateral reversal of the dorsoventral axis in part of the spinal cord of Amblystoma punctatum. C. Hutchinson, Yale University and The Wistar Institute. (Introduced by R. G. Harrison.)

The dorsoventral axis of one half of the spinal cord in the brachial region of Amblystoma punctatum larvae was inverted by rotating one lateral half of the medullary plate at the proper level. The following factors make typical neural-tube formation impossible in the region of the graft. 1) Immediately after the operation, the mesoderm underlying the graft grows up between the 2 halves of the medullary plate, completely separating them. 2) During neural-tube formation, the grafted half folds away from the contralateral half of the host rather than toward it so that normal approximation and fusion of the medullary folds cannot take place. Despite these mechanical obstacles, the spinal cord usually regulates so as to appear typical by the tail-bud stage. Chief among the factors bringing this about is the rapid growth of the myotomes which tends to crowd the separated halves of the cord together. Once the 2 halves touch, influences within the nervous system itself operate to complete reconstitution. The behavior pattern develops normally and the cord appears typical in outline, but a histological study shows that true inversion has occurred. The only absolute criteria are the Rohon-Beard cells which can be positively identified, and in the region of the graft these are displaced from their normal dorsal position to a ventral position, where primary motor neurons usually develop.

129. The production of a supernumerary limb in Amblystoma punctatum by the transplantation of a tail bud from Rana sylvatica. E. D. Goldsmith, Harvard University. (Introduced by Leigh Hoadley.)

In a series of experiments involving the transplantation of tail buds from Rana to Amblystoma larvae, one case in which a supernumerary limb developed was observed.

The tail bud from Rana sylvatica, in early tail-bud stage, was grafted into the somitic region posterior and dorsal to the typical fore-limb region of an Amblystoma punctatum in stage 29.

Thirty-three days after the operation, a small knob of tissue, similar to the host in pigmentation, appeared dorsal to the frog tail. Two days later, circulation was observed in the new structure, whereas none was yet visible in the transplant. Twelve days after the appearance of the outgrowth, the distal portion showed 4 slender projections; subsequently, the growth became limb-like in appearance.

During metamorphosis the supernumerary limb changed its orientation so that it no longer parallels the original fore limb, but now extends posterodorsally. The proximal third adheres to the flank, while the distal portion is independent with its digits outstretched in fan fashion and closely applied to the body.

Stimulation of the additional limb with a paraffined thread elicits a response from the animal as a whole, but not from the stimulated member, indicating that there is functional sensory, but no functional motor innervation.

From the pigmentation and mode of appearance of the limb it would seem certain that it is composed of Amblystoma, not Rana tissue. A histological examination has not yet been made, since, 7 months after the operation, the animal is alive and under observation.

130. The effects of x-radiation on the development and regeneration of the early fore-limb bud of Amblystoma punctatum. W. O. Puckett, Princeton University. (Introduced by E. G. Butler.)

One fore-limb bud was removed from larvae of Amblystoma punctatum in stages 33–39 (Harrison) and the larvae given daily x-radiations in toto. In no cases do such radiated larvae regenerate the fore limb. Only a small pointed spike grows out from the site of the amputated bud. In unradiated control animals normal regeneration of a 4-digit limb is complete 18 to 20 days after amputation.

Radiation also affects normal limb development. The unoperated bud grows out to form an imperfect limb which never has more than 2 digits. Hind limbs which in control animals appear 7 to 9 days after the start of the experiment have not appeared in such radiated larvae after 25 days.

A histological study of the spikes formed in radiated embryos on the site of the amputated fore limb shows an absence of cartilage formation. In only one of 12 older embryos sectioned is there a suggestion of a scapular cartilage on the operated side. Sections show that an apparently normal scapular cartilage differentiates on the unoperated side and representative cartilages form in the limb of this side. No trace of a mesenchymal condensation leading to cartilage formation in the pelvic region is to be found in the radiated animals.

A detailed histological study is now in progress, as well as studies on stages slightly older than those mentioned above.

131. Fragmentation by centrifugal force of the eggs of four Neopolitan sea urchins and development of the halves and quarters. Ethel Browne Harvey, Princeton University.

The eggs of Sphaerechinus granularis, Parechinus (Echinus) microtuberculatus, Paracentrotus (Strongylocentrotus) lividus, and Arbacia pustulosa were stratified and broken apart by strong centrifugal force. The stratification always includes a layer which stains purple with methyl green (mitochondria?), but is differently located in different species. The pigment band of the Paracentrotus egg is not displaced, but only stretched. The eggs are broken into 2 definite parts, one with a nucleus, one without, and often a connecting strand between; these 2 halves are in many cases broken into quarters. The fragments are fairly definite in size for any one centrifugal speed, but the size varies with the speed; in 3 species the granular (heavier) sphere increases in size with higher speed.

All the halves and quarters, both nucleate and non-nucleate (ephebogenetic), can be fertilized, form fertilization membranes, cleave, and develop, some into normal dwarf plutei. When the halves are connected by a strand, either one or both parts may receive a sperm, and either one or both parts may develop. In one batch of eggs of Paracentrotus, the eggs constricted into three parts of constant definite size, each of which received a sperm and developed.

Half and quarter eggs, both nucleate and non-nucleate, can be cross fertilized in approximately the same percentage as the whole eggs. Some of the cross fertilized non-nucleate halves were raised to plutei.

132. Effects of centrifugal force on fertilized eggs of Arbacia punctulata as observed with the microscope centrifuge. Ethel Browne Harvey, Princeton University.

Fertilized Arbacia eggs, from which fertilization membranes have been removed, can be observed to break readily into 2 parts with strong centrifugal force, until about 20 minutes after fertilization when they become increasingly resistant. This resistance may be overcome by keeping the eggs previously in Ca-free sea water. From 5 to 20 minutes after fertilization they break with very long streamers between the halves which retract on slowing down the centrifuge. Fertilized eggs, centrifuged rapidly while the membrane is forming, break into halves and quarters more readily than unfertilized eggs. If centrifuged slowly, the membrane is stretched and the egg breaks into two spheres inside the membrane: the sperm may be in either sphere and either or both spheres may develop, or the 2 spheres may coalesce on retraction of the membrane. Fertilized eggs can go into the 2-celled stage while rotating on the microscope centrifuge, the division plane passing through the oil cap. Parthenogenetic eggs act in exactly the same way as fertilized eggs at all stages.

133. The development of bilaterality in an amphibian (Triturus) egg. Francis G. Gilchrist, Pomona College.

A study with the aid of spots of Nile-blue sulphate. The entrance point of the sperm is on the pigmented cap and has no fixed relation to future bilaterality. Neither has early obliquity of the egg axis. From hour 2 to 4 after laying (at 18°C.) the egg becomes increasingly fluid and flat-topped within the spherical chorion; the second polar body is given off; and the early obliquity of the axis decreases. From hour 6 to 8 the egg rotates ventrally; a white dorsal crescent becomes visible from above; and in most eggs pigmented striations parallel to the future dorsal meridian appear extending from the entire dorsal margin of the pigmented cap across the crescent. Blue spots placed on the margin of the pigmented cap streak downward with the pigment. Spots on the dorsal side and 45° from the vegetal pole streak upward. Spots placed in an intermediate position themselves become heavily streaked. Evidently the streaking is not due to a streaming of pigment and blue-stained granules either upward or downward, but is due to a local condensation into striae of a thin overwash of pigment or stain. Evidence indicates that the dorsal crescent is highly fluid, probably as the result of the movement of water to the dorsal side. This produces rotation and in turn the streaking. From hours 9 to 11 two hummocks develop on the ventral half of the flattened upper surface. Surface material, especially from the dorsal side, flows toward the cleavage furrow which deepens between them.

134. The mitotic index in the early development of fish embryos. A. Richards, Ray P. Porter, and Babette Leyens Shumacker, University of Oklahoma.

A study of the mitotic index (the ratio of dividing cells to the total number) in a young embryo offers a means of analysis of the steps by which differentiation is brought about. The mitotic indexes of early stages of 2 fish embryos, Fundulus and Corregonus, were studied up to the closure of the germ ring. The

material of the 2 fish was not exactly comparable, for Fundulus eggs in summer temperature develop about 5.5 times as fast as Corregonus eggs in late fall; the White fish blastodiscs, therefore, were less advanced than those of Fundulus, and the early embryonic shields were more advanced. The respective values for the embryos of various ages for Fundulus and Corregonus are as follows:

Blastodisc (definitely formed blastula)	61.0 per cent;	82.7 per cent
Beginning of germ ring	3.82 per cent;	1.86 per cent
Beginning of embryonic shield	3.04 per cent;	0.52 per cent
Late embryonic shield	2.53 per cent;	
Stages with complete embryonic axis	1.70 per cent;	1.70 per cent

Values were also determined for the different layers and anlagen of the organs, and 'critical movements of origin' (Stockard's terms) found to be clearly indicated, with surprising agreement in the 2 genera. The method offers a means for determining areas of prelocalization. Both cell division and cell migration contribute to the formation of the embryonic shield and later also to the formation of embryonic axis. In addition, involution and epiboly are involved in gastrulation. Concrescence is comparatively insignificant in formation of the shield. Formation of neural cord is by uniform elongation, not from posterior region. Transformation of cord into brain vesicles is chiefly by cell division.

135. THE BEHAVIOR OF INDIVIDUAL NERVE SPROUTS, SHEATH CELLS, AND MYELIN SEGMENTS DURING GROWTH AND REGENERATION OF THE PERIPHERAL NERVES IN LIVING SALAMANDERS. Carl Caskey Speidel, University of Virginia.

The essential stages in the process of neurogenesis have been watched in living larvae of the red-spotted salamander (Triturus viridescens). Individual nerve fibers and sheath cells have been kept under observation for prolonged periods, both in normal and experimental animals. The phenomena of nerve growth and repair in salamanders (urodeles) are fundamentally like those in frog tadpoles (anurans).

Ameboid growth cones. In newly regenerating regions the first, second, and later growth cones of single nerve fibers have been observed as they migrate outward by ameboid movement toward the skin, thus forming the earliest cutaneous nerves. Among the activities exhibited by these growing nerve tips are extension, retraction, branching, change of direction following an encounter with an obstacle, neuroplasmic currents along a fiber stimulated by an adjacent growth cone contact, and increase in rate of movement of a growth cone correlated with mitosis of a fibroblast in close proximity to it.

Sheath cells. Observations on sheath cells include records of their movement peripherally (less frequently centrally) along the early unmyelinated nerves, their proliferation by mitosis, their transfer from one nerve fiber to another, and their role in the formation of the neurilemma and myelin.

Myelin segments. A myelin-sheath segment is produced through the cooperative activity of a sheath cell and a myelin-emergent fiber. Complete case histories of the origin and growth of about 20 myelin segments show that this process is quite similar to that already described for frog tadpoles. Observations have also been made revealing the response of the myelin sheath to irritating stimuli, and its restoration after traumatic degeneration, or after trophic degeneration.

CYTOLOGY

Read

136. THE EFFECTS OF X-RAYS ON THE CHROMOSOMES OF CIRCOTETTIX VERRUCULATUS (ORTHOPTERA). E. R. Helwig, University of Pennsylvania. (Introduced by the Secretary of the Society.) (10 min.)

When a simple or reciprocal translocation between non-homologous chromosomes has occurred in a spermatogonium the attraction of homologous elements at synapsis results in the union of chromosomes, which are not wholly homologous, and, consequently, compound or multiple chromosomes should be present in the primary spermatocytes. Multiples of this nature are commonly found in individuals of Circotettix verruculatus after they have been exposed to x-rays.

The multiples are of two types: circles or closed rings and chains or open rings. The circles are formed as a result of a reciprocal translocation between non-homologous chromosomes. The chains may be formed in several different ways, but most frequently they are the result of the translocation of a section from one chromosome to a non-homologous chromosome. Sometimes they appear to be caused by a reciprocal translocation in which one of the segments has become attached in an inverted position; thus making synapsis with its homologous section impossible. Other arrangements of the chromatin may be less frequently responsible for the formation of chains.

In the anaphase of the first maturation division the configuration of both the circles and chains is usually such that the segregation of homologous elements is complete. However, in a small number of the cells, the structure is such that segregation is only partial.

137. THE HISTORY OF A SPECIFIC CHROMOSOME IN AMBLYSTOMA TIGRINUM DURING KARYOKINESIS AND INTERKINESIS, WITH SPECIAL REFERENCE TO THE BEHAVIOR OF THE NUCLEOLUS AS A LOCALIZED PORTION OF A DEFINITE CHROMOSOME. William H. Dearing, University of Pennsylvania. (Introduced by Phillip P. Calvert. (Lantern; 15 min.)

The complete history of a particular chromosome, of which the nucleolus is a part, has been traced throughout the successive stages of mitosis. As this chromosome progresses through the various stages of karyokinesis and interkinesis, the corresponding changes in the morphology and staining reaction of the nucleolus were carefully followed.

Each of the 2 nucleoli of Amblystoma tigrinum somatic epithelial cells is subterminally located in the short arm of 1 of 2 particular V-shaped chromosomes. The latter are probably homologues.

In this subterminal chromosome position the nucleolus exhibits in fixed and stained preparations an achromatic character in late prophase, metaphase, anaphase, and early telophase, while it presents itself as a chromatic element in middle telophase, late telophase, interkinesis, and early prophase. The nucleolus is not a simple homogeneous body, but rather a complex structure, the nature of which is revealed in the study of its evolution during the chromatic phase of its cycle in mitosis.

The full history of the nucleolus-containing chromosome during interkinesis and karyokinesis furnishes evidence for the material continuity and individuality of the chromosome, for the nucleolus makes it possible to identify the nucleolus-containing chromosome in the complicated stages of late telophase, interkinesis, and early prophase.

138. Chromosome numbers and their origin in parthenogenetically developed larvae and frogs of R. pipiens and palustris. C. L. Parmenter, University of Pennsylvania. (Lantern; 15 min.) (Also by demonstration.)

Ten larvae are pure haploids, 4 larvae and 5 frogs are pure diploids, 2 haploid larvae possess 2 to 4 diploid cells, one larvae has a mixture of about half haploid and half diploid cells, 2 larvae are diploid-triploid, and one larva is pure triploid. Observations were made on uncut cells in toto mounts of body wall, tail epithelium, peritoneum, and gonad. A delay of approximately one cleavage period during the first cleavage of 3 metamorphosed frogs suggests that diploidy was produced by a monaster, or an anastral mitosis (Bataillon and Tchou Su, '29) before first cleavage. Since, however, diploid larvae also arise from embryos having no delay in cleavage, this latter diploidy must have been produced either by retention and fusion of the second polar body with the egg nucleus, or by a diploid number of chromosomes in the egg when it was pricked. The presence of 2 to 4 diploid cells in otherwise haploid larvae demonstrates that regulation occurred in the tail epithelium cells during the last 1 or 2 mitoses and therefore that cells of haploid embryological transplants may become diploid. The pure triploid probably originated by the fusion of a retained haploid second polar body with a diploid female pronucleus formed by monaster or anastral mitosis before first cleavage. The diploid-triploid combination may have originated by a similar fusion of retained second polar body with one of the diploid nuclei of a 2-celled embryo.

139. The chromosomes of Schizodactylus monstrosus. C. E. McClung, University of Pennsylvania. (Lantern; 15 min.)

The remarkably constant picture of chromosome conditions in the orthopteran germ cells shows marked changes in a very unusual Indian form, Schizodactylus monstrosus, belonging to the aberrant group, Gryllacrinae. The unusual features relate to number, form, size, and behavior. The male diploid complex contains 14 chromosomes, 5 of which are atelomitic and 9 telomitic. The forms of the chromosomes are so distinctive that each is recognizable, particularly in the first spermatocyte. Compared to the other orthopteran chromosomes, those of Schizodactylus are quite small. Within the complex a range of 1 to 10 in volume exists. Most unusual for an Orthopteran is an X-Y pair. The unusual chromosome conditions are accompanied by similar departures from type in cell and organ structures.

140. The migration of leucocytes through the tubal mucosa of the bat. Mary J. Guthrie, University of Missouri. (5 min.)

Supravital studies on the reproductive tracts of female bats of 6 species from the genera Myotis, Pipistrellus, and Eptesicus revealed the presence of leucocytes in the tubes, uterus, and vagina from the onset of hibernation until the period of ovulation. These leucocytes ingest large numbers of spermatozoa and are extruded from the tract in the vaginal contents. A cytological study of the tubes of Pipistrellus subflavus subflavus has shown that leucocytes are present beneath the mucosa and pass between the ciliated epithelial cells into the lumina. Such migration is particularly conspicuous in the ostial regions which are packed with leucocytes when the spring insemination and ovulation occur.

141. Growth stages in the egg of Bombyx mori. Hope Hibbard, Oberlin College. (Lantern; 10 min.)

The long ovarioles of insects with their procession of cells from undifferentiated ones at the upper end to the mature eggs at the lower end give a well-known opportunity for observing progressive cytological changes in eggs. In Bombyx, fixed as well as living eggs have been studied and additional information is here added to the known facts of the storage of yolk, fat, and glycogen in the egg cytoplasm, the distribution of mitochondria and Golgi bodies, and the role of the egg and nurse-cell nuclei in the process.

At first egg and nurse cells are indistinguishable, both having similar chromatin content (Feulgen reaction) and both showing polarized nebenkern in the cytoplasm. The first visible difference is in the nucleus when the chromatin threads condense to form tetrads in the nurse cells while remaining filaments in the egg. The nurse-cell nuclei show changes from tetrads to groups of fine granules, then to evenly distributed granules. Meanwhile the egg and 8 nurse cells take their place at the upper end of the tubule, the egg cytoplasm connected by wide bridges with the 2 adjacent nurse cells, which in turn are connected with the next ones. Through these channels, vacuoles, fat, mitochondria, and glycogen pass down into the egg cytoplasm where yolk granules are built up, fat is distributed and increased, and glycogen stored. The egg nucleus loses all stainability with Feulgen, and lies an inert ball shoved to one side by the flow of material into the egg from without. The nuclei of the nurse cells, on the contrary, become enormous, branched, crammed with chromatin, and seem alone concerned with the vegetative activities of the egg cell.

142. The origin of asters during maturation, fertilization, and early cleavage in Chaeptopterus eggs. Henry J. Fry, New York University. (Lantern; 15 min.)

Asters are generally described as having 2 diverse modes of origin: first, they may arise as new structures, having no continuity, as asters, with preceding ones; secondly, they may arise by the division of preexisting asters, thus exhibiting genetic continuity, as asters, from one cell cycle to the next. This behavior of the asters may be studied as such, regardless of the behavior of the central bodies.

Both modes of astral origin have been described in Chaetopterus eggs (Mead, '98). A reexamination of the same material, using Boveri's picro-acetic reagent diluted, yields the following results: 1) The first polar body figure arises as 2 asters appearing simultaneously. 2) The second polar body figure also arises as 2 new asters, which appear together, after the telophase aster of the preceding figure has disappeared. 3) The first cleavage figure likewise arises by the simultaneous formation of 2 new asters, which appear after the sperm-aster has largely disintegrated. 4) The 2 prophase asters of the second cleavage figure also arise together as new structures, while the old monocentric telophase aster of the former aster is still present.

Hence in this material all asters arise as new structures, and not by the division of preexisting asters. If a reexamination of other cases of supposed astral division should show that such is actually not the case, and that asters generally arise as new structures, this would clarify the problem of their mode of origin.

143. The reticulation reaction of the colored corpuscles of several marine invertebrates to vital dyes. Alden B. Dawson, Harvard University. (Lantern; 10 min.)

One of the distinctive cytological features of the vertebrate erythrocyte is the characteristic reticulation reaction of its cytoplasm when exposed to approximate concentrations of such vital dyes as neutral red and brilliant cresyl blue.

Comparable observations have been made on the colored corpuscles of several invertebrates: Phascolosoma gouldi, a gephyrean worm; Glycera dibranchiata, a polychaete worm; Thyone briareus, a holothurian; and Arca transversa, a mussel. The corpuscles of Phascolosoma contain hemerythrin, while those of the other three contain hemoglobin. All the corpuscles react in a manner very similar to that of the vertebrate erythrocyte and develop typical patterns of reticulation when stained supravitally. The uniformity of the reaction in both invertebrates and vertebrates suggests that in the elaboration of the intracellular respiratory pigment, whether hemoglobin or hemerythrin, the synthetic processes are fundamentally similar.

144. The transformation of adipose tissue in the guinea-pig testis following experimental tuberculosis. (1) George A. Baitsell, Yale University. (Lantern; 15 min.)

In The American Review of Tuberculosis (vol. 21, '30) a description was given of the process of intercellular fibrous tissue formation in the testis of the guinea-pig following experimental tuberculosis. The results gave evidence that the newly formed fibrous tissue had its origin in an exudate which later became directly changed into the fibrous connective tissue.

The results presented in the present communication are concerned with the histological changes which take place in the infected adipose tissue of the fat-body and which culminate in an abundant and widespread formation of fibrous tissue. The histological observations show that rapid and important tissue changes take place following the invasion of the tubercle bacilli. In a comparatively short time the characteristic structure of the adipose tissue is almost

completely transformed by the development of large areas of fibrous tissue. A little later, numerous, well-developed tubercles, infiltrated and enclosed by fibrous tissue, make their appearance throughout the infected regions. The evidence at hand seems clearly to indicate that the newly formed fibrous tissue has its origin in an abundant intercellular exudate which gradually becomes directly transformed into the dense fibrous tissue. The work was done under a grant from the Medical Research Committee of the National Tuberculosis Association.

145. MATHEMATICALLY PRECISE FEATURES OF EPITHELIAL MOSAICS. Frederic T. Lewis, Harvard Medical School, Boston, Massachusetts. (Introduced by E. L. Mark.) (Lantern; 15 min.)

Whenever a solid is covered with polygonal facets having 3 edges meeting at every vertex (which is the stable condition in semifluid bodies) the total number of sides of the polygons is 12 less than if they were all hexagons. The 6 square faces of a cube have 24 sides and not 36. The 14 faces of the average cell of precartilage, fat, pith, etc., have 72 sides instead of 84, whatever the combination of polygons covering the cell. If n is the number of faces, $6(n-2)$ is their number of sides. Similarly, the cellular mosaics completely covering or lining any simple cavity, e.g., the Amphioxus blastula or the epithelium of a thyreoid follicle, cannot be composed entirely of hexagons: there must be 12 unmatched pentagons, or an equivalent deficiency in sides. When, from such a mosaic, villous or spiny elevations arise, or tubular pits develop, the pits or elevations are capped by polygons having a deficiency of 6 sides; and around their orifices or bases, there is an excess of 6 sides, so that the formula $6(n-2)$ still applies to the entire formation. Its application to capillary and branching vessels will be shown, and the effects of anastomoses. The modification of the formula to include 4-rayed and other unstable vertices is simple. Thus cell patterns present inevitable geometrical features significant in the ultimate interpretation of cells in ways which will be indicated.

By demonstration

146. CENTRAL BODY BEHAVIOR IN BRAIN CELLS OF DOGFISH EMBRYOS. Henry J. Fry and C. W. Robertson, New York University.

Centrioles were studied in cells of the ependymal layer of brain tissue in Squalus embryos, the technique being modified as to fixation, depth of stain, and environmental factors.

The mitotic figure is anastral. The behavior of the centriole is as follows: 1) It does not divide during mitosis. 2) Because of problems of visibility the only dependable evidence concerning any relation between the presence of the spindle and that of the centriole is available during telophase, when spindle-end and centriole disappear simultaneously, although the midregion of the spindle still persists. 3) The shape of the centriole is related to that of the spindle end. 4) Its distinctness, at metaphase, is related to that of the spindle fibers (although this relationship is modified during telophase). 5) Progressive destaining gradually decreases the size of the centriole until it disappears, and

at every stage in the process the spindle fibers continue to make contact with it. 6) Midbodies arise only at points where the fibers of the midregion of the spindle are focalized by the cleaving cell; their size is radically modified by the depth of stain; they disappear as the fibers fade.

The centriole, like the midbody, is probably a focal staining artifact, resulting from accumulations of dye at points where fibers converge. The facts of Pollister's study ('29) of centrioles in pancreas cells of Mustylus can be explained by this interpretation.

147. Central body structure in Chaetopterus eggs at metaphase, first cleavage, as demonstrated by various fixatives. Henry J. Fry, New York University.

Chaetopterus eggs at metaphase, first cleavage, were fixed in many standard reagents, variously modified, to determine whether the results previously obtained by varying the picro-acetic technique (Fry, '32) apply to reagents generally.

The conclusions are as follows: 1) As in the preceding investigation, the central body area is very unstable, its physical structure being related to the coarseness and shape of the rays. 2) Also as in that work, a typical minute centriole is demonstrated only under narrowly limited conditions of fixation, necessitating extensive dilution. More than 140 formulae were used, and centrioles are shown under only 3 conditions: *a*) when Bouin's fluid is diluted with 90 to 99 parts of water (picric acid being present from 0.08 per cent to 0.008 per cent by weight, acetic acid from 0.5 per cent to 0.05 per cent, formol from 0.8 per cent to 0.08 per cent); *b*) when Huettner's modification of Kahle's fluid is diluted with 95 parts of water (alcohol 1.1 per cent by weight, acetic acid 0.1 per cent, formol 0.2 per cent); *c*) when acetic acid is used alone in a 0.01 per cent solution. 3) A very large, Ascaris-like centriole occurs in some cells, although there is much variability in structure from cell to cell, when a chloroform-acetic mixture is used (chloroform 0.61 per cent by weight, acetic acid 1.0 per cent), or an ether-acetic mixture (ether 0.71 per cent, acetic acid 1.0 per cent). 4) Whenever a centriole is demonstrated—which occurs only when rays are very coarse and relatively straight—the general cytoplasm is so poorly fixed that it looks as though it had cytolyzed before it coagulated.

148. The chromosomes of pigeons and doves. Robert T. Hance, University of Pittsburgh.

The exact chromosome number has not been determined, although there are probably 50 or more. The sex mechanism is essentially as represented by Oguma and Painter, the sex chromosomes being the largest in the complex. This material is somewhat more favorable for cytological study than the domestic fowl as the chromosomes are larger and appear better separated.

149. Intranuclear crystalloids in the superficial epidermal cells of the catfish. Alden B. Dawson, Harvard University.

Crystal-like bodies are found within the nuclei of superficial cells of the epidermis of the catfish. They are uniformly present in cells bearing a striated border and are also frequently seen in the cells immediately below. They appear as clear, refractile bodies in cells freshly scraped from the epidermis and are unstained by Wright's method. In sections, following Helly fixation and Mallory's phosphotungstic acid-hematoxylin stain, they are colored deep purple or black. The crystalloids are relatively constant in length and in general appear lath-shaped, but it is difficult to distinguish the form of the faces. They vary in size, some being narrow and almost needle-like, while others are relatively wide. They do not deform the nuclei to any great extent. The number in any one nucleus is variable. They sometimes occur singly, but as many as 10 may be present. They may lie parallel or cross each other at varying angles.

150. The zone of Golgi in the surface epithelium of the stomach of the Necturus. Alden B. Dawson, Harvard University.

Sections of the stomach of Necturus prepared by Parat's modification of Smith-Dietrich technique showing the 'zone of Golgi.'

151. Histological changes in the body of Placobdella parasitica associated with hypodermic impregnation. Raymond J. Myers, University of Pennsylvania. (Introduced by J. Percy Moore.)

In the absence of a penis in Placobdella parasitica the seminal fluids are encased in secreted capsules called spermatophores. During copulation these are attached to the body surface of other individuals of like species at various places usually between segments 8 and 24. The seminal fluid is then injected into the body of the recipient and ultimately reaches the ovisacs, where fertilization is effected.

Associated with the infiltration of the seminal fluid are definite histological changes in the body wall, notably, destruction of the cell elements in the hypodermis, in the underlying connective-tissue layer, and in the connective tissue surrounding the muscle fibers of this region. Thus a conducting path for the spermatozoa between the attached capsule and the body sinuses is established. With the spermatic elements introduced into the body there is an accumulation of undifferentiated cells into the affected region. By a differentiation of these the destroyed cells and tissues are replaced and the wound is repaired.

152. The histophysiology of the amphibian thyroid following experimental release of the stored secretion. Madeleine P. Grant, Smith College. (Introduced by the Secretary of the Society.)

The report is based upon histological study of thyroids of about 50 Necturus larvae averaging 75 mm. in length. Three daily injections of an emulsion of the pars anterior from 2 freshly killed frogs caused on the following day a practically complete release of the stored thyroid secretion. Without further

stimulation, animals with glands thus emptied were placed in tap-water or weak iodine solutions. By the end of 12 days no evidence of refilling of the follicles could be observed. The numerous, deep-staining, colloid droplets previously described in cells active in releasing stored secretion, had completely disappeared. The cells were now filled with a large, faintly staining vacuole which appeared in the basal, apical, or paranuclear position. This is the pattern of the thyroid cell following withdrawal of excessive pituitary stimulation. It suggests the cell in the process of synthesis.

Factors controlling the refilling phenomenon now appear of special interest. To test the suggestion, occasionally appearing in the literature, that the complete thyroid cycle, namely, release, synthesis, and storage, is controlled by the pituitary, a series of experiments involving repeated injections of the emulsion is in progress. From a preliminary examination of these, it appears possible that the refilling process is thus stimulated, and also that the pattern under these conditions is identical with that of the follicle during release—a theory previously suggested by the writer from a study of the thyroid of urodeles during metamorphosis.

153. The effect of homoplastic anterior-pituitary implants upon the thyroid of Necturus larvae. Madeleine P. Grant, Mary Clapp, and Mary Ruby, Smith College. (Introduced by the Secretary of the Society.)

No experimental procedure thus far tried has stimulated metamorphosis in Necturus, although Swingle ('22) showed that the Necturus thyroid caused metamorphosis when implanted into the body of the tadpole, and Charipper ('30) demonstrated that the Necturus pars anterior caused the same reaction through stimulation of the tadpole thyroid. Also Grant, ('30) reported an increased activity in the Necturus thyroid following implants of the frog pars anterior.

The reaction of the Necturus thyroid to increased doses of its own pituitary is the only test not yet reported to complete the investigations concerning potencies of the Necturus thyroid-pituitary complex, responsible for metamorphosis in other species. To test this, implants of the pars anterior from adult Necturi averaging 12 inches in length were made into the body of Necturus larvae averaging 47 mm. in length. Histological study of thyroids of 18 larvae killed from 12 to 96 hours following implantation showed a hyperactive gland in all cases. The advanced stages showed the greatest activity in which the follicular cells were filled with stainable, colloid droplets and non-staining vacuoles. A marked reduction in the amount of stored colloid was also evident.

It thus appears evident that the thyroid of Necturus reacts to increased doses of its own pituitary and supports all previous findings concerning the physiological potencies of its endocrine equipment. Additional indirect evidence is thus given to support the theory, first suggested by Noble ('27), that neoteny must be explained in terms of genetic immunity of the body tissues to secretions of the thyroid.

By title

154. STAINING REACTIONS OF PROTOPLASM AND ITS FORMED COMPONENTS: A CYTOLOGICAL AND BIOCHEMICAL STUDY. Katharine R. Jeffers, Bryn Mawr College and University of Missouri. (Introduced by Mary J. Guthrie.)

Chemical analyses of the lipoids in fresh and autolyzed pancreas of the cat have been correlated with the staining reactions of sections of this organ preserved by 3 cytological methods. Quantities of total fat and of phospholipins, the iodine numbers of total fats and of phospholipins, and the free fatty acid numbers were determined. None of the methods of fixation used reveals the total fat content of the tissue. The intensity of staining of material fixed by Helly's method and stained with acid fuchsin is dependent on the phospholipins of the tissue, but the nature of the relationship is not certain. The intensity of staining of sections preserved by Champy's method and stained with acid fuchsin may best be correlated with the iodine number of the phospholipins of the tissue. The degree of blackness of sections preserved by the Kolatchev-Nassonov method may also be correlated with the iodine number of the phospholipins of the tissue. The free fatty acid content is probably an additional significant factor. Lipoids are demonstrated qualitatively rather than quantitatively by these methods. Only physiologically similar tissues can justifiably be compared by the cytological methods studied. No new evidence has been secured concerning the chemical nature of the chondriosomes or of the Golgi substance.

155. A STUDY OF THE 'INTRACELLULAR STRUCTURES OF EBERTH.' Isabelle Weed, State University of Iowa. (Introduced by H. W. Beams.)

The 'intracellular structures of Eberth' may be seen in the basal epidermal cells of Rana clamitans tadpoles as coarse threads which stain black with Heidenhain's iron hematoxylin. In some preparations they may be seen to be composed of delicate individual fibrils which enter at the base of the cell from the corium beneath and twist together within the cytoplasm to form a more massive cord which at its upper extremity often completely encircles the nucleus. This suggests that they may be of connective-tissue nature, an hypothesis which is further supported by the fact that, with Mallory's triple connective-tissue stain, these structures take an orange color, while the cytoplasm stains red. Also, an occasional section shows a thread which has apparently been torn from the cytoplasm during preparation and may be seen outside the cell, but still attached to the corium.

These structures may be demonstrated following non-mitochondrial fixatives, thus suggesting that they are not of mitochondrial origin. Moreover, in material fixed with modified Flemming's solution, mitochondria in the form of granules or short rods are to be seen in the same cell with these intracellular threads.

156. Cytological studies on the pharyngeal glands of the worker bee, with special reference to the intracellular secretory canaliculi, Golgi bodies, and mitochondria. H. W. Beams and R. L. King, State University of Iowa.

The pharyngeal glands of the worker bee are situated in the upper and anterior part of the head cavity. Each gland consists of a rather long common chitinized duct to which are attached numerous lobules which are composed of groups of one-cell glands usually 10 to 20 in number. Each of the unicellular glands in the lobule is individually connected to the main duct by a fine chitinous tubule which arises with the tubules of the other cells in the neck of the lobule.

Each efferent tubule loses its chitin at the surface of the cell which it penetrates and takes the form of a simple tubule which coils about the nucleus to end blindly in the cytosome. At times large secretion masses, through and between which the intracellular tubule penetrates, are present in the cytoplasm, between the nucleus and cell membrane.

Neither the Golgi bodies nor the mitochondria seem to play any direct part either in the formation of the secretion or its passage into the intracellular duct.

157. The epidermal 'glands' of Ceratodus and Protopterus. Clifford H. Alvey, New York University. (Introduced by H. A. Charipper.)

Skin from selected portions of the head and trunk regions of Ceratodus forsteri and Protopterus aethiopicus was fixed in Bouin's fluid, cut in serial sections, and stained with Delafield's haematoxylin and eosin. In Ceratodus, epidermal 'glands' are numerous in the cephalic region, frequently arranged in groups of 2 or 3. In the trunk region they occur singly and are fewer in number. The 'glands' are short tubular depressions of the epidermis, with a bulbous blind end partially embedded in the connective tissue. The bulbous portion is composed of basal, sensory, and mantle cells, characteristic of sensory organs as found in fish and amphibians. Columnar cells line the neck of the organ. The distribution of these structures in Protopterus is similar to that in Ceratodus, except that they are less numerous and occur singly. They are more deeply situated than those of Ceratodus, although the fundamental structural pattern is similar. In both genera, the columnar cells which line the neck of the organ give evidence of a secretory function, whereas certain cells of the bulbous portion appear to be sensory. It is probable that these 'glands' combine a secretory and sensory function and that they should be added to the list of sensory organs. These observations agree with those of Fahrenholz ('28) on similar structures in Lepidosiren.

158. Notes on the cytology of the rat's liver. Edith M. Jay, State University of Iowa. (Introduced by H. W. Beams.)

In sections from livers injected through the vascular system with Carter's carmine-gelatin or with Berlin-blue gelatin masses at known, constant pressures, many cells were observed to contain ovoid or spherical bodies of the colored injection masses, similar to those described by Schäfer and his students, Herring and Simpson, as 'intracellular blood canaliculi.' In these livers practically all of the cells were vacuolated. However, with livers that had been injected with

a Berlin-blue gelatin mass dissolved in Locke's solution instead of distilled water, there were no intracellular masses and the cells appeared normal, though the sinusoids were completely filled with the injection mass. The so-called 'intracellular blood canaliculi' described by Schäfer and his students are interpreted, therefore, as artifacts produced by a combination of factors, the most important of which is the difference in osmotic pressure which is produced by the hypotonicity of the injection masses that are usually used, coupled perhaps to a less degree by the effect of mechanical pressure used in administering the injection mass.

Following impregnation of liver tissue by Golgi's rapid method, the usual network of intracellular bile canaliculi was revealed, but the presence of a permanent system of intracellular canaliculi was not observed, though it has been reported by various workers. Short, knob-ending intracellular projections from the intercellular bile canaliculi were noticed in a few cells; these are suggested as representing the passage of secretion material into the intercellular bile canaliculi at the moment of excretion.

159. A PRELIMINARY REPORT ON THE HISTOLOGY OF THE BODY FLUID OF MELLITA QUINQUIESPERFORATA (LESKE). Ellinor H. Behre, Louisiana State University.

The body fluid of the keyhole urchin contains at least 8 distinct types of cell. Since in all echinoderms as far as is known there is some connection between the haemal system and the other cavities of the body, these cells may be considered blood cells. They are: 1) Red berry-like amoeboid cells. 2) Colorless berry-like amoeboid cells, somewhat larger than 1. Both of these types appear vesicular, as if made up of compartments filled with fluid. 3) Large non-granular compartment cells, resembling early stages of a cleaving egg, and first mistaken for such. They are the largest formed elements present, and often contain bits of red pigment. 4) Small flagellate cells containing each a single large green body. 5) Granular amoeboid cells smaller than 3, larger than 1 and 2, containing many large granules of irregular shapes and brownish tinge, which move about freely in the cytoplasm. 6) Cells like 4, only more fusiform, smaller, and with stiff bristle-like flagella and no distinguishable contained bodies. 7) Cells like 5, but consistently smaller, with granules proportionally larger and of distinctly greenish tinge. 8) Small, finely granular amoeboid cells usually with many ray-like pseudopodia, or rounded with no processes. These may be merely different stages of type 6. Studies regarding the behavior of these cells in tissue culture are in progress.

160. HISTOLOGICAL CHANGES IN THE GONADS ASSOCIATED WITH SEX REVERSAL IN THE AMERICAN OYSTER (OSTREA VIRGINICA). W. R. Coe, Yale University.

The seasonal changes of sex reported for this species are found to be based upon the essential bisexuality of the primary gonads. These appear to be similar in all individuals at the age of 3 or 4 months, with a cortical zone of scattered ovocytes and a central mass of spermatogenic cells. In the majority of young animals, however, the rapid proliferation of spermatogonia soon gives the gonad a characteristically male appearance. Spermatogenesis is completed

the following spring and such individuals function as males in their first breeding season. After the discharge of the spermatozoa the residual cells of the gonad still retain their bisexual characters and in these cells lies the prospective potency of a later sex reversal. The proportion of individuals which thus function first as males seems to vary in different localities from 70 to 80 or even 95 per cent. Usually 1 to 2 per cent are self-fertile hermaphrodites. A differential rate of sex reversal is presumably responsible for the approximation of equality in the sex ratio in the older age groups.

Since the mean size of the small proportion of yearling oysters in the female phase is considerably greater than that of the males of the same age and since the proportion of females is largest in those localities where the conditions for growth are the most favorable, it is assumed that the nutritive conditions at the critical time of sexual differentiation are in large measure responsible for the sexual phase which the individual will show at the next breeding season.

161. Cellular changes during the regeneration of small pieces of Planaria agilis. C. Kenneth Collings, University of Missouri. (Introduced by Mary J. Guthrie.)

The role of the formative cells in the regeneration of planarians, and particularly the source of the great increase in numbers of these cells during regeneration was investigated. Very small pieces of worm, with a dorsal surface 1 to 1½ mm. square, were used, since it was believed that these small pieces should show the maximum activity of a relatively small number of formative cells. It was found that all the new tissues studied were formed by the differentiation of formative cells, most of which had migrated through the parenchyma to the region of differentiation. No proliferation of preexisting differentiated tissues was observed. The so-called 'Zellen zu Strängen' formed during the development of new gut were composed of formative cells. The formative cells have their immediate origin from preexisting formative cells which divide by mitosis. Neither amitosis nor dedifferentiation and redifferentiation was observed. Calculations made from counts of formative-cell mitoses indicate that the number of cells produced by this method is sufficient for regeneration.

162. Histological changes in the alimentary tract and pancreas of anuran larvae during involution. R. G. Janes, New York University. (Introduced by O. M. Helff.)

Histological sections of the stomach, small intestines, and large intestines of R. clamitans have been made at progressive metamorphic stages. The histolytic phenomena associated with the digestive tract and the development of gastric glands, external circular muscle layers, and the mucosa muscularis have been studied. The work of Kuntz, regarding passage of cellular elements during intestinal atrophy into the lumen of the intestines, has been confirmed. In addition, numerous eosinophyllic leucocytes have been observed in the stomach and intestines, especially as they function during ingestion of histolyzed cellular elements. The atrophy of the alimentary tract during metamorphosis, therefore, is the result not only of sloughing of cells into the lumen, but also to cellular histolysis coupled with phagocytosis.

The pancreas was likewise sectioned at successive stages of transformation from the larval to the adult form and the various histological changes studied. The most apparent change concerns the early breaking up of the acinus groups and their subsequent reformation with considerably enlarged acinar cells. The acinar cells also become more elongated and near the completion of the metamorphic period contain numerous zymogen granules. The elimination of cellular elements during pancreas atrophy would seem to take place, partially at least, through the pancreatic ducts. The breaking up of acini liberates masses of acinar cells which gain entrance to the ducts; presumably then passing down into the lumen of the intestines.

163. The Golgi bodies in the male germ cells and nerve cells of mantids. R. L. King and H. W. Beams, State University of Iowa.

The Golgi bodies in the prophases of the first spermatocytes of Tenodera sinensis may be seen in the living cells and are preserved after fixation in Flemming's or Allen's B-15 solutions and staining in iron hematoxylin or safranin. They might be considered nuclear exudates (chromidia), both because of their apparent sudden appearance and because of their position almost in contact with the nuclear membrane. They are also preserved after mitochondria fixatives and stain with Janus green intravitam at this stage and so might be mistaken for chondriospheres. However, the structure and behavior of these Golgi bodies may be completely determined at all stages only after osmic or silver impregnation and have been found to correspond closely in these respects to other insects. In the spermatids the Golgi bodies do not fuse to form a single acroblast, but remain as discrete bodies in the midst of which the acrosome appears. We have in these germ cells typical insect Golgi bodies which compare closely to those described by the authors for the nerve cells of the same species. Some have thought that this type of Golgi body (dictyosome) was present only "in the very special case of male germ cells" and that "the time is not yet ripe for sweeping attempts to homologize the dictyosomes with elements in somatic cells and particularly in such highly specialized objects as nerve and gland cells."

It is important to emphasize here that the insect Golgi bodies are to be recognized by their structure and behavior rather than by their staining reactions either intravitam or after fixation.

164. Golgi bodies and yolk formation in the egg of the guinea-pig. H. W. Beams and R. L. King, State University of Iowa.

Preliminary observations have failed to disclose the filtration of Golgi material through or the presence of fine radial canals in the zona radiata of the egg of the guinea-pig, as reported for some mammals. The Golgi bodies of the follicle cells are not regularly polarized adjacent to the zona radiata.

There is no apparent relationship between the Golgi material and the formation of yolk or other cytoplasmic inclusions in these eggs.

165. Cytoplasmic constituents of the somatic cells of the earthworm. I. In the nephridia. H. S. Fish, Harvard University. (Introduced by Alden B. Dawson.)

With common cytological methods, the general characteristics of Golgi bodies and mitochondria are revealed in the earthworm nephridia. Benham describes these nephridia as consisting of, I) muscular duct; II) large wide tube; III) short brownish ciliated tube; and, IV) long narrow tube, ending in, V) the ciliated nephrostome.

Golgi bodies vary in size from small rings with chromophilic borders and chromophobic centers (II, preseptal portion of IV, V) to rather larger similarly stained rings closed or open or curled rods (I, II, IV), to large, irregularly shaped, crinkled, or twisted discoid bodies or open rings (III, IV).

Golgi bodies may be scattered in the cytoplasm of the epithelium (I, III, IV) or appear as discrete bodies rather closely aggregated, frequently associated in single or multiple pairs (II, III). In thin-walled tubules (I, IV) they show no definite position with respect to lumen and duct wall. In thicker portions of tubules, they are found close to the lumen, or approximately midway between the lumen and duct wall (II to IV). Generally, the long axis of Golgi rods coincides with that of the tubule, and rings present their flat surfaces to the lumen. Golgi bodies are rarely perinuclear in the tubules. In marginal cells of V they are aggregated between the ciliated surface and nuclei and also surround the latter.

Mitochondria appear as tenuous filaments arranged in a loose network, small granules, or larger scattered spheres (found principally in III). In II filamentous mitochondria give a striated appearance to the tube wall.

166. A comparative study of hemopoietic loci in urodeles. I. Spleen, liver, and epicardium. W. C. Barrett, Jr., Harvard University. (Introduced by Alden B. Dawson.)

A comparative study of hemopoietic loci in urodeles, representing every family except the Proteidae, shows that the spleen is the chief center of erythropoiesis and thrombopoiesis. Granulopoiesis is not, however, restricted to one organ, but may occur in the epicardium, liver, mesonephros, and bone marrow.

The epicardium of the bulbus of the heart in Pseudobranchus, Amphiuma, and Amblystoma larvae presents an extensive loose connective area which is considered a potential site for granulopoiesis. This area in Pseudobranchus is granulopoietic, containing eosinophils, and neutrophils.

Granulopoiesis in the liver occurs in 3 well-defined areas. The perihepatic subcapsular granulopoietic layer is invariably present, although varying in extent. This layer is widest in the Amblystomidae, Cryptobranchidae, and Amphiumidae. In the Plethodentidae, Gyrinophilus has an extensive perihepatic layer, as do Typhlotriton and Typhlomolge. Eurycea and Desmognathus, however, have very narrow, discontinuous layers. In the Sirenidae, Pseudobranchus has a narrow perihepatic area, while Siren has an extensive one.

Cryptobranchus and Siren also have extensive perirenal centers of hepatic granulopoiesis. Pseudobranchus, Amphiuma, Amblystoma, and Typhlotriton have similar, but less extensive areas, which, in the last 2 forms, are always associated with hepatic ducts.

Amblystoma, in addition, shows large, numerous, isolated, intrahepatic centers of granulopoiesis. These, though smaller and less numerous, are present in Typhlotriton larvae and adults.

Siren differs from all other urodeles studied in having intrahepatic, subcapsular cords of pancreatic tissue, and between these and the hepatic cells an extensive granulopoietic layer. This condition is found elsewhere only in teleosts.

167. A COMPARATIVE STUDY OF HEMOPOIETIC LOCI IN URODELES. II. MESONEPHROS, BONE MARROW, AND SKELETOGENOUS SEPTA. W. C. Barrett, Jr., Harvard University. (Introduced by Alden B. Dawson.)

The mesonephroi of certain urodeles contain important centers of granulopoiesis which may be classified as intertubular, interrenal, and perirenal, subperitoneal areas. Renal granulopoiesis in the urodeles is never so extensive, however, as in larval anurans, and is limited to larval or neotenous forms.

Pseudobranchus, Siren, larvae of Amblystoma, and Cryptobranchus show varying amounts of intertubular granulopoiesis. Pseudobranchus and Siren, as well as Typhlotriton larvae also exhibit marked perirenal subperitoneal areas. All of these forms show, in addition, well-defined interrenal centers which are concentrated in the connective tissue about the dorsal aorta. In Siren, Amblystoma larvae, and Cryptobranchus the perirenal areas are best developed in the connective tissue about the wolffian ducts.

The bone marrow of certain urodeles also contains an extensive area of granulopoietic tissue exceeded in amount only by those of the liver. In Gyrinophilus it is the bone marrow of the femur which is granulopoietic. Few eosinophils are present and the marrow cavity is packed largely with neutrophils in an advanced stage of development.

Typhlotriton larvae have important granulopoietic centers in the bone marrow of the neural and hemal arches of the caudal vertebrae which produce both neutrophils and eosinophils. Caudal granulopoiesis is not restricted to the bone-marrow, however, but occurs in extensive areas in the loose connective tissue in and lateral to the intervertebral spaces as well as in the connective tissue dorsal and ventral to the vertebrae.

168. INDIVIDUALITY OF THE RED BLOOD CELLS IN INBRED STRAINS OF FOWLS. A. W. Kozelka, University of Chicago. (Introduced by F. R. Lillie.)

Agglutination tests were made with both monovalent and polyvalent sera on birds belonging to several breeds of fowls and on birds of inbred strains. The sera were prepared by immunizing rabbits with washed corpuscles of fowls.

No racial difference in the agglutinogens was evident; the same agglutinable properties were present in the individuals of the various breeds, but were variously assorted in the different individuals.

The number of blood types is large. This does not necessarily mean that there is a large number of factors underlying the reaction, but rather that there is a variable assortment of a small number of factors in the different individuals. Evidence for this interpretation was suggested in a number of experiments.

While the individuals in some of the inbred strains with a coefficient of inbreeding of slightly more than 50 per cent showed individuality in their agglutinogens, others showed well-defined blood types with both monovalent and polyvalent sera. In contrast to the variation in the agglutinogens in unrelated birds, there was a relatively high degree of homogeneity in the agglutinogens among individuals of inbred strains due undoubtedly to the mendelian transmission of the factors responsible for the formation of the agglutinogens.

169. THE CULTURE OF MITOCHONDRIA. C. T. Hurst and J. C. Strong, Jr., Western State College of Colorado. (Introduced by the Secretary of the Society.)

The writers seem to have been able to grow mitochondria in artificial media. After much experimentation, a nutrient fluid was prepared that gave good results. This fluid was a liver-infusion medium prepared from the livers of albino mice. Before use it was adjusted to pH 7.2, the point determined by repeated experiments to be the most favorable for the growth of mitochondria. The medium was always inoculated under absolutely aseptic conditions, in a specially constructed apparatus. Material for inoculation was obtained from the crushed liver of the albino mouse. A culture showing numerous mitochondria was obtained. From this 4 subsequent serial subcultures were obtained. Every check was used to rule out all possible bacterial contamination. The cultured material was specific to Janus green B in the 1: 500,000 dilution. Each granule seemed to be enclosed in a lipoid membrane that was optically apparent. Self-perpetuation by fission was observed.

PROTOZOÖLOGY

Read

170. INHERITANCE OF THE NOTCHED FORM OF CHILODON UNCINATUS, A MUTATION PRODUCED BY THE USE OF ULTRAVIOLET RAYS. Mary Stuart MacDougall, Agnes Scott College. (Lantern; 10 min.)

In an old culture of Chilodon uncinatus which had been exposed to the action of ultraviolet rays for 15 seconds at 4-day intervals, a notched form arose. It apparently died out, and no attention was paid to it until its reappearance for the fourth time. After the animal was isolated and studied, it was found that the notch was due to a defect in one of the vacuoles. This form does not survive in the homozygous condition. The heterozygous form is easily distinguished by an enlarged vacuole. Upon conjugation, 2 such heterozygous forms give less than 25 per cent notched, approximately 25 per cent normal, and from 50 to 60 per cent heterozygous forms. The notched forms divide a few times, then die, the nuclei becoming progressively abnormal.

171. NUCLEAR STRUCTURE, MITOSIS, AND CHROMOSOME INDIVIDUALITY IN AN OPALINID (PROTOZOA, CILIATA). T. T. Chen, University of Pennsylvania. (Introduced by D. H. Wenrich.) (Lantern; 15 min.) (Also by demonstration.)

In a species of Zelleriella, the spherical or slightly elongated nucleus contains during interkinesis, 1) a chromatin reticulum which later gives rise to chromosomes and, 2) a few masses of material which stain intensely with haematoxylin, but do not stain by the Feulgen technique.

The behavior of the chromosomes is strikingly similar to the behavior of the chromosomes in metazoan cells. This involves a transformation of the chromatin reticulum into a spireme, condensation, and shortening of the chromosomes, their collection at the equator of the nucleus, longitudinal splitting, and movement of daughter halves toward opposite poles, and finally the gradual transformation of daughter chromosomes into chromatin reticulum in the daughter nuclei. Among the 24 or 25 chromosomes found, the 6 shortest ones could be recognized in every dividing nucleus on account of their differential size.

The masses referred to above are highly variable as to shape, size, and number in the resting stage and the stages of mitosis, and marked differences may occur between the nuclei of the same animal. Their exact nature has not been determined.

The nuclear membrane is persistent throughout mitosis as in the majority of Protozoa. Division of the cell body may take place at the metaphase, the telophase, or in intermediate stages of nuclear division. Cases in which the division of the cell body had been delayed were also observed.

172. A GENETIC STUDY OF THE REDUCTION DIVISION IN PARAMECIUM AURELIA. Daniel Raffel, Yale University. (Introduced by W. R. Coe.) (Lantern; 10 min.)

The investigation presented here was designed to ascertain from genetic evidence which of the maturation divisions of the micronuclei at conjugation is the reduction division. The results clearly demonstrate that the final division is at least partly a reduction division. Nine experiments were performed in which the progeny of the members of each pair of large populations of exconjugants were compared. In each of the experiments either a small positive correlation or no significant correlation was found between the members of the pairs. In one experiment sister lines descended from the first 2 progeny of each exconjugant were also compared. A large positive correlation was found between the sister lines.

If the final division of the micronucleus is an equational division, the migratory and stationary pronuclei produced by it would be alike, and therefore the 2 members of each pair would be identical in their genetic constitutions. As the progeny of the 2 members of each pair are not identical and are less alike than sister lines, the final division of the micronucleus must be at least in part reductional. Moreover, further analysis indicates that, by postulating dominance and the occurrence of mutations, all the experimental results might be accounted for if reduction occurs only at the final maturation division.

173. Observations on the morphology and division of a monad flagellate, with a discussion of the genus Monas. Bruce D. Reynolds, University of Virginia. (10 min.)

The taxonomic condition of the genus Monas is chaotic. Many forms have been described as new species without sufficient basis. In this paper an attempt is made to clarify some of the points which have led to confusion. The morphological observations involve a study of the flagella and their behavior during division.

By demonstration

174. The relation between the form of the living cell and the nuclear phases of division in Amoeba proteus (Leidy). H. W. Chalkley and George E. Daniel, National Institute of Health.

The phenomena of division in Amoeba proteus were observed in a large number of specimens at 24°C. The nucleus cannot be seen in the living cell after the first few minutes of prophrase. The cell in preparation for division rounds up and becomes studded with fine pseudopodia. The pseudopodia become coarser. The cell finally elongates and divides. There is a quantitative relationship between the width of the pseudopodia and the nuclear phases prior to elongation. Making use of this relationship, it is possible to select from culture with great accuracy amoebae in any desired phase of nuclear division, except the actual moment of the splitting of the equatorial plate, thus providing a technic for the physiological study of the division phases. Amoebae so selected were fixed and stained, the stained preparations showed that the nucleus divide mitotically. The nuclear membrane vanishes and the contractile vacuole apparently disappears with the splitting of the equatorial plate. At 24°C. cell division requires approximately 33 minutes; about 10 minutes is taken in prophase, about 5 minutes in metaphase and about 10 minutes and 8 minutes in anaphase and telophase, respectively.

By title

175. A method for culturing Bursaria truncatella. Amos Benkov Kuan-Chim Penn, Johns Hopkins University. (Introduced by S. O. Mast.)

Add one gram of timothy hay, one gram of rye, and 5 grams of fresh cabbage to 600 ml. of spring water. Boil slowly for 5 minutes. Let stand uncovered for 2 days to allow development of bacteria, then remove the cabbage, add 500 ml. spring water, transfer 250 ml. of the solution with corresponding amounts of hay and rye to each of several half-liter jars and inoculate with Paramecium, Colpidium, and Chilomonas. After 2 or 3 days, i.e., when these organisms have become abundant, inoculate with Bursaria. Cover the jars and keep them in indirect sunlight at room temperature.

If a film of gummy substance has developed on the surface of the infusion, break it. If no gummy substance is present, add some from an old culture.

A culture thus prepared reaches a flourishing condition ($10 \pm$ individuals per ml.) in 2 or 3 days, and continues in this condition for 3 or 4 days. If the infusion is more dilute, the cultures flourish longer, but the Bursaria does not become so abundant.

176. Strength of culture medium as a factor in fission rate of Paramecium caudatum. George A. Smith, Brown University and Carnegie Institution of Washington. (Introduced by A. M. Banta.)

The fission rate of Paramecium caudatum was studied, 1) with different strengths of culture medium, 2) with different amounts of culture medium, and, 3) with different numbers of animals in each of the combinations of strengths and amounts of culture medium. Normal culture medium was made by adding 900 cc. of boiling distilled water to 15 grams of chopped oat straw and allowing to stand for 48 hours. The strength of culture medium used was made to range from $\frac{1}{32}$ normal to 12 times normal. Likewise, the number of animals per drop was varied from 1 to 5, and the amounts of culture medium from 1 to 5 drops. Experiments were with animals in depression slides in sealed moist chambers at 25°C.

Results indicate that fission rate of animals reared in solutions materially weaker or stronger than normal strength is, in general, reduced. At 10 times normal, fission is practically eliminated. At 12 times normal, the animals died. While, 1) the volume of drop culture and, 2) the number of animals in a given volume influence fission rate to some extent, 3) the strength of culture medium seems most to affect it. Retardation of fission attributable to accumulated excretory products, rather than to strength of culture medium (presumably its bacterial content), was not recognized. Concentration of culture medium (presumably excess or deficiency of food) seemed to be the predominating factor in limiting fission rate.

177. Some salt-marsh ciliates in California. Harold Kirby, Jr., University of California.

In 2 salt marshes at Monterey Bay and San Francisco Bay faunus of ciliates resembling those described by Kahl ('28) from brackish water at Oldesloe, near Hamburg, have been encountered. Among several species of Sonderia, one is new, characterized by the possession of a long, tubular cytopharynx reaching posteriorly to or beyond the middle of the body. Cryptopharynx setigerus Kahl has frequently been found. The entire dorsal, non-ciliated surface is covered with closely set, very small spines. Kahl's description of a gelatinous, finely punctate investment covering the hump probably was due to misinterpretation of this covering of spines. A new species of Peritromus often is associated with Cryptopharynx. Fabrea salina Henneguy, which is not uncommon, lives in water of rather high concentration, and is able to thrive at salinities too high for most Protozoa. The collections made were obtained from water of 7.5, 12.3, and 20 per cent salinity. Conjugation has been observed. The ciliates have been cultivated for 3 years simply by adding a few rice or wheat grains to unfiltered, unsterilized sea water of the proper concentration. Spirorhynchus verrucosus Cunha has also been found. An unusual feature of this ciliate is the investment covering the body from the base of the rostrum to the base of the caudal projection. Cunha described this as composed of protuberances similar to those of Vorticella monilata. Instead, however, there are groups of vertical rodlets, probably vertically adherent bacteria. Three spherical macronuclei are situated close together in the anterior portion of the body.

178. Observations on the feeding habits of Lesquereusia spiralis, Difflugia oblonga, and Difflugia constricta. A. B. Stump, University of Virginia. (Introduced by Bruce D. Reynolds.)

Lesquereusia spiralis, Difflugia oblonga, and D. constricta were observed feeding on certain filamentous green algae. This feeding habit, while similar to that of Vampyrella, apparently is unreported for these rhizopods. The algal cells are entered by tearing or ripping the cell wall from the outside, without a softening or dissolving of the cellulose. Shortly after the cell is entered, plasmolysis takes place, and there is a tendency for the cell to become detached from the rest of the filament. The contents of the algal cells are removed probably by suction. Very little difference was noted in the feeding actions of the various rhizopods observed, except that there seemed to be a direct relation between the size of the animals and the size of the algae they could use for food. Lesquereusia spiralis and Difflugia oblonga were observed feeding on several species of Spirogyra, Oedogonium, and Zygnema, while D. constricta, the smallest of the 3 species, fed only on the last 2 algae named.

179. The method of ingestion in Peranema trichophorum. R. P. Hall, New York University.

Additional evidence has been obtained which supports the view of Schaeffer ('18), Tannreuther ('23), Jollos ('25), Hall and Powell ('27, '28), and Loefer ('31) that, in the Peranemidae, food particles are ingested by way of the gullet ('reservoir') which is homologous with the gullet found in species of Euglenidae and Astasiidae. Observations on living specimens and on fixed and stained preparations of Peranema trichophorum have confirmed this interpretation of Schaeffer and others, and the stages of ingestion which have been observed fail to reveal any evidence to support the contention of Rhodes ('26) and Brown ('30) that there exists in the Peranemidae a new mouth opening which is entirely separate from the gullet ('reservoir') characteristic of the Euglenida as a group.

180. Synthesis of protoplasm from inorganic compounds in the colorless animal, Chilomonas paramecium. S. O. Mast and D. M. Pace, Johns Hopkins University.

Chilomonas paramecium is often found in great abundance in water containing decaying organic material. It usually contains much starch and fat. We ascertained the effect of various environmental conditions by studying it in aseptic isolation cultures of known composition.

In water containing $Na(C_2H_3O_2)$, NH_4Cl, $MgSO_4$, and K_2HPO_4, it produced in 49 days 166.6 generations, 3.4 per day; and in this solution plus Na_2SiO_3, 3.9 per day.

In this solution minus $Na(C_2H_3O_2)$, i.e., in a solution containing no organic compounds, it divides at practically the same rate for 3 or 4 days and then dies, but if the CO_2 concentration of the air is increased, it continues indefinitely in excellent condition, either in light or in darkness. The CO_2 concentration is optimum in a mixture of 1 part CO_2 and 5 parts air. In low CO_2 concentration

the specimens decrease greatly in size, the starch diminishes rapidly, and death is probably due to starvation. If Na_2SiO_3 is omitted, Chilomonas divides only a few times, then dies.

Chilomonas can consequently, without light, synthesize carbohydrates, fats, proteins, and protoplasm from inorganic compounds, obtaining nitrogen from NH_4 and carbon from CO_2. Nitrates are produced in this process. The energy required is therefore obtained from oxidation of NH_4. Na_2SiO_3 probably acts as a catalyst.

The results obtained indicate that only 8 chemical elements are necessary: N, C, H, O, K, Mg, P, and S.

181. Relation of pH of the medium to growth of Euglena deses and E. anabaena var. minor in light and darkness. R. P. Hall, New York University.

In a medium composed of Difco 'tryptophane broth' and certain inorganic salts, growth of E. anabaena var. minor occurred in light within the limits pH 4.7 to 8.3; growth of E. deses, from about pH 5.3 to 7.8. Maximum growth of the former was noted at pH 6.9; of the latter, at pH 7.0. In darkness, slight increase in numbers was noted between pH 5.2 and 7.7 in the case of E. anabaena, but only at pH 6.7 and 7.0 in E. deses. In 1 per cent Difco 'proteose-peptone' the growth range of E. anabaena was from pH 5.5 to 7.7; that of E. deses, from about 5.7 to 7.5. In darkness, there was no multiplication of E. deses, and only a slight increase in numbers of E. anabaena at pH 6.9. In neither type of medium was there any indication of a 'photodynamic effect' (Alexander, '31).

182. Relation of hydrogen-ion concentration to growth of Chilomonas. J. B. Loefer, New York University. (Introduced by R. P. Hall.)

The relation of pH of the medium to growth of Chilomonas paramecium in bacteria-free cultures was investigated, growth being measured by the Sedgwick-Rafter counting-cell method. Three types of media were used: Difco 'tryptophane broth' (0.25 per cent), Difco 'Bactopeptone' (1 per cent), and Difco dextrose broth (0.25 per cent) were added to solutions of certain inorganic salts. At a temperature of 27.5°C., growth occurred from pH 4.2 to 7.9. Two growth 'maxima' were noted in each type of medium, one at pH 4.7 to 5.3, and the other at 6.9 to 7.2. After 3.5 days of incubation, the pH of cultures about the acid 'optimum' had shifted slightly toward the alkaline side. This increase in pH suggests either a utilization of some of the buffers originally present, or else the appearance of basic substances as a result of enzymatic deaminization.

183. Effects of certain carbohydrates on growth of Euglena anabaena var. minor in darkness. R. P. Hall, New York University.

To a standard medium containing certain inorganic salts and organic nitrogen sources, the following carbohydrates were added in a concentration of 0.25 per cent: dextrose, levulose, lactose, maltose, sucrose, dextrin, and soluble starch. Tubes of each type of carbohydrate medium and of the control medium

were inoculated with E. anabaena (bacteria-free strain, Pringsheim). After incubation, final counts (Sedgwick-Rafter method) for the carbohydrate media were compared with the controls and with the initial count. Although growth was slow in all series and not perceptible other than by the counting method, multiplication occurred in the presence of dextrose and levulose, and to a smaller degree in the presence of maltose. No multiplication was apparent in the other carbohydrate media or in the controls.

184. Effects of certain amino acids on growth of Chlorogonium and Chilomonas. J. B. Loefer, New York University. (Introuced by R. P. Hall.)

Amino-acid media were prepared by adding the following amino acids to a solution containing certain inorganic salts: asparagin, dl-isoleucine, glycine, l-leucine, dl-valine, l-tyrosine, dl-leucine, and dl-β-phenylalanine. Except for l-tyrosine (saturated solution), the amino acids were used in a concentration of 0.15 per cent. Bacteria-free cultures were incubated in light at 27.5°C., and growth was measured by the Sedgwick-Rafter counting-cell method.

Counts of C. euchlorum were made after 2 and 4 days. Growth occurred in all the amino-acid media; asparagin showed the maximum growth, while dl-leucine and dl-β-phenylalanine were least favorable to growth of this species. Growth of C. elongatum, after 6 days of incubation, was greatest in the l-tyrosine medium, relatively slight in glycine, dl-valine and dl-β-phenylalanine, and intermediate in the remaining amino-acid media.

Similar series of experiments with Chilomonas paramecium showed growth in the following amino-acid media: asparagin, dl-isoleucine, glycine, l-leucine, dl-valine, and dl-leucine.

185. Species differences in growth characteristics of Chlorogonium. J. B. Loefer, New York University. (Introduced by R. P. Hall.)

Bacteria-free strains of Chlorogonium euchlorum and C. elongatum, grown in media containing Difco 'Bacto-peptone' or Difco 'dehydrated tryptophane broth,' in a concentration of 0.25 per cent, showed a growth range of pH 4.6 to 8.7. Maximum growth of C. euchlorum occurred slightly below 7.5, while the optimum for C. elongatum was near pH 8.0 under similar conditions.

Marked differences in growth rate are evident, C. elongatum growing more slowly in all media thus far used. For example, the generation time, calculated for a 3-day period in a medium containing asparagin and inorganic salts, was 10.5 hours for E. euchlorum and 39 hours for C. elongatum. In a similar medium containing l-tyrosine as a nitrogen source, the generation time was 11.9 hours for the former and 20.6 for the latter. Even on comparing, in the series of amino-acid media used, the shortest generation time for C. euchlorum with the shortest for C. elongatum, the former is seen to multiply approximately twice as rapidly as the latter. Similar differences are evident in growth of the 2 species in other types of media, e.g., Difco 'tryptophane broth,' Difco 'Bacto-peptone,' and media containing various carbohydrates. These differences in growth rates appear to be correlated with size of the organisms, since the larger species, C. elongatum, shows a consistently lower growth rate than C. euchlorum.

186. Effects of population density on the rate of reproduction in Oxytricha. Willis H. Johnson, Wabash College. (Introduced by W. C. Allee.)

There was no difference in the reproductive rate of Oxytricha when isolated singly and in twos into 1 and 2 drops of hay medium for 24 hours. When animals were isolated singly and in twos into 5 and 10 drops of hay medium, a higher reproductive rate was found in cultures starting with 2 animals. Hay cultures, varying in volume from 1 to 40 drops, and inoculated with single animals, showed the highest reproductive rate in the 1- and 2-drop cultures and progressively decreasing rates in the 5-, 10-, 20-, and 40-drop cultures. Changes in temperature, changes in H-ion concentration, and the use of paraffin-lined dishes did not change these results. Suspensions of the bacterium Pseudomonas fluorescens in a non-nutritive balanced physiological salt medium were found to be the best type of culture medium tried for Oxytricha. Suspensions of this kind of bacteria in densities of 80 to 135 million per cubic centimeter were optimal for maximal reproduction in Oxytricha. There was no difference in the reproductive rate of 1 and 2 Oxytricha in 2 drops of this optimal density during 24 hours. In 2 drops of supra-optimal densities, 2 Oxytricha reproduced faster than 1, except in very dense suspensions where reproduction was inhibited. In suboptimal densities, the reproductive rate of single Oxytricha was highest in the largest volumes of medium used.

187. Structure and function of the so-called 'Glanzkörper,' 'nutritive spheres,' 'Golgi bodies,' or 'spherical bodies' in Amoeba proteus. S. O. Mast and W. L. Doyle, Johns Hopkins University.

Amoeba proteus contains numerous highly refractive spherical bodies which vary greatly in size, the largest being 10 μ in diameter. They consist of a thin fragile shell which surrounds a central fluid mass and which in turn is surrounded by a thin fluid layer. This layer stains crimson with neutral red and is oily in consistency. The shell and the central mass do not stain. If they are squeezed under a cover glass, the outer layer flattens, the shell breaks, and the central substance flows out. If several in contact with each other are repeatedly lightly squeezed, the outer layers intermingle to form a continuous substratum through which the shells and their contents are scattered.

If amoebae are centrifuged while suspended in a solution of soluble starch, they elongate greatly, the fat aggregates at the end toward the axis of the centrifuge, the spherical bodies at the opposite end, and the nucleus, the contractile vacuole, the crystals and other substances in various regions between. Recovery is complete in 2 to 5 minutes at room temperature. Removal of the end containing the spherical bodies has no noticeable effect on the amoebae. Two specimens without any spherical bodies were from time to time carefully studied under low and high magnification for 14 days. No new spherical bodies formed. However, feeding, excretion, locomotion, and responses were normal, but there was no reproduction either in these specimens or in the centrifuged controls. The origin and function of these bodies is consequently as yet unknown.

188. Reappropriation of cytoplasmic fragments. I. In different concentrations of hydrogen-ions, and, II. Under the influence of an electric current. E. D. Miller, University of Virginia. (Introduced by Bruce D. Reynolds.

Under normal conditions, Arcella discoides will move toward and reunite with a severed fragment of cytoplasm. When cultured in media with H-ion concentrations varying from 5.0 to 7.6 the contact and fusion rates are normal. If the pH be greater or less than the above-mentioned values, the contact and fusion rates, and also the rate of reproduction, are retarded.

When placed in a weak electric current, arcellae usually move toward the anode. The effects of an electric current on contact and fusion rates are similar to those produced by the H-ion concentrations, i.e., practically negligible. This suggests that cytoplasmic attraction and fusion between an arcella and its detached fragment are probably of a chemical nature.

189. An investigation of the question of cytoplasmic fusion in Amoeba proteus. Katharine S. Brehme, University of Virginia. (Introduced by Bruce D. Reynolds.)

In Amoeba proteus, cytoplasmic fusion does not take place between an organism and its own fragment, between an organism and a fragment from another individual, or between two cytoplasmic fragments. In this respect its reactions differ from those reported for various thecamoebae.

190. The vacuome and so-called 'canalicular system' of Colpidium. R. P. Hall and C. H. Alvey, New York University.

The writers have attempted to confirm Cosmovici's description of a 'canalicular system,' consisting of a coiled canal extending from the cytostome to the cytopyge and a supplementary capillary network lying just beneath the pellicle. The canal was not observed in normal ciliates, in specimens immersed in soluble-starch solutions and later stained with iodin, or in a number of types of stained preparations. On the basis of Cosmovici's figures and the writers' observations, the supposed capillary network appears to be merely the surface markings of the pellicle, erroneously interpreted as an intracytoplasmic network. Cosmovici has concluded that his 'canalicular system' represents the vacuome of Colpidium. The writers, however, have demonstrated a distributed vacuome, consisting of scattered neutral-red-stainable globules, which is comparable to the vacuome described in many other Protozoa.

191. Reorganization of the axostyle in polymastigote flagellates. Harold Kirby, Jr., University of California.

There is conclusive evidence that in division of trichomonad flagellates the axostyle is resorbed and new ones are developed. Some have described growth from the blepharoplasts. Others have claimed that the elongated paradesmose, centrodesmose, or spindle is transformed into the daughter axostyles, or influences their differentiation. The apparently clearest description of this in

polymastigote flagellates was supplied by Janicki ('15) in Devescovina. Observations by the writer of division stages in five members of the subfamily Devescovininae, including three species of Devescovina, one of Metadevescovina, and one of Parajoenia, have shown that the old axostyle, though persisting until after the nucleus has completed its division, eventually is resorbed. New axostyles grow from the region of the blepharoplasts, beginning in the prophase. Unlike the parabasals, growth is not completed until plasmotomy is in progress, or later. Finally, when the nuclei are at opposite ends of the elongated, dividing body, the greatly elongated paradesmose extends between the blepharoplasts and is longer than the combined length of the two unseparated daughter individuals. The paradesmose stains deeply with iron-haematoxylin, while in later stages the axostyles are demonstrated poorly, because of the absence of the numerous adherent granules of the earlier stages. As the filament lies close to each axostyle, often against it for the full length, it is possible to misinterpret the figures, as Janicki did. In some species the paradesmose disappears after plasmotomy; in others it persists as a slender filament along the membrane of the trunk of the axostyle.

ANATOMY

Read

192. MORPHOLOGICAL CHANGES IN THE MUCOUS MEMBRANE COVERING EDENTULOUS AREAS OF THE ALVEOLAR PROCESS IN THE HUMAN MOUTH. W. H. Wright, University of Pittsburgh. (Introduced by H. H. Collins.) (Lantern; 8 min.) (Also by demonstration.)

The mucous membrane of the human mouth may be subject to numerous environmental conditions. A study of the morphological changes of tissues from 5 of these conditions is presented.

The first group included mucous membrane, taken from a normal environment. The morphological pattern of the tissues was normal.

The mucous membrane in the second group had been subject to abnormal pressure from foods. The epithelium had proliferated into the underlying stroma, and cornification of the surface cells was present.

Tissues in the third group had been traumatized by contact with opposing teeth. The epithelial papillae were blunt or club-shaped and sometimes completely destroyed. Cornification was present except when the teeth came in contact with the tissue.

The mucous membrane in the fourth group had been protected by bridge work. The tissues were loosely held together, irregular in form, devoid of cornification, and sometimes hydropsical in nature.

In the fifth group the tissues which had been supported by prosthetic dentures varied in their reactions. Some were normal; others were abraded and infiltrated with round and plasma cells. There was no cornification.

It is assumed from this study: that normal function maintains normal form of mucosa, that cornification results from active brushing of the tissue by foods, that epithelium is less plastic than connective tissue; that individual cells of the epithelium are the last elements to change their form, and that the mechanical factor is the dominant agency in morphological changes in the oral mucous membrane.

193. THE BLOOD OF THE DUCK. Thos. B. Magath and Geo. M. Higgins, Mayo Clinic and Mayo Foundation, Rochester, Minnesota. (Lantern; 12 min.)

The normal picture of the blood of the domestic duck is presented with illustrations of the various cells. Measurements, frequences, and types of cells are recorded. A comparison of this blood is made with that of other fowls and a detailed study of the reticulocyte is given.

194. GERM-CELL CYCLES IN THE AMPHIBIAN, TRITURUS VIRIDESCENS. Helen Marie Hilsman, University of Pittsburgh. (Introduced by H. H. Collins.) (Lantern; 7 min.) (Also by demonstration.)

Mature Triturus viridescens exhibit a phenomenon called the 'false breeding season' in addition to the true breeding season. For the male this is in reality a second true breeding season, because spermatophores are deposited; but since no eggs are laid, it remains a false breeding season. Pope ('24) has described the external manifestations such as the appearance of secondary sexual characters and amplexus which mark the false breeding season. Up to the present time, however, the cytological relationships have not been thoroughly understood.

Recent studies on the testis of mature males have revealed 2 independent spermatogenetic cycles which are directly correlated with the true or spring breeding season and the fall or false breeding season, because the sperm are developed precisely at the time of these 2 seasons. Each germ-cell cycle requires 12 months for the completion of the stages and may readily be divided into 3 periods, namely, spermatogonial, developmental, and evacuational.

The fall cycle requires 4 months' time to develop each of the 3 periods, but the spring cycle needs 8 months for the spermatogonial period and 2 months each for the developmental and evacuational periods. The quantity of sperm produced in the spring cycle is actually less than the number found in October. However, some of the sperm of the fall cycle are not deposited during the false breeding season, but are held in the ducts to be used in the spring. In the meantime, the testis is preparing a new aggregation of sperm.

By title

195. STRUCTURE OF THE HAIR OF THE SEI WHALE (BALAENOPTERA BOREALIS) Leon Augustus Hausman, Rutgers University.

Eight shafts of hair from the muzzle of the sei whale, or Rudolphi's rorqual (Balaenoptera borealis) were examined, after treatment with various microscopic oils, to bring out the medulla, fusi, pigment granules, cortex, and cuticular scales. Hair shafts from species representing every other order of existing mammals had been examined, but never before any shaft from a member of the Cetacea. It was found that, in respect of morphological form of scales, medulla, fusi, and pigment-granule pattern, no differences were observable beyond those which had been predicted for hair shafts of this diameter and color. This added weight to the conclusions already arrived at, that these elements in mammalian hair-shaft structure are correlated with shaft diameter (or color, as the case may be), and not primarily with the systematic position of the species

bearing the hair. Certain departures from this general rule (observable in the hairs of this whale and of other mammals), but few in number, though possibly of a signification yet understood, are now being worked on in the writer's laboratory. The hairs of the whale in question were much fragmented, and bore colonies of a curious diatom which is figured in the paper. (The paper will appear in the American Naturalist.)

PARASITOLOGY

Read

196. Notes on the genus Isospora (Coccidia) in captive birds. Donald C. Boughton, Johns Hopkins University. (Introduced by Robert Hegner.) (Lantern; 10 min.)

From the few reports in the literature and the preliminary observations reported here, it appears that the genus Isospora is found in a large number of avian hosts. Since the parasitism of a great many birds by this genus of protozoans presents material for the study of several problems of general biological interest, further information regarding its distribution among bird species is desirable. Fecal examinations of captive birds in the Milwaukee Zoological Gardens revealed several new hosts among the Passeres. Certain groups, notably the Psittaci and the Gallinae, were conspicuously free from isosporan infections. A diurnal periodicity, which restricts the appearance of the oocysts to certain hours of the day (approximately, 3 P.M. to 12 midnight), was demonstrated for several species of birds. In future work this factor must be taken into account, since miscellaneous microscopic examinations of intestinal contents or droppings made without regard to time of day are of doubtful significance in determining the incidence of infection.

197. Studies on the trematode genus Clinostomum. I. The yellow grub of fish and frogs. George W. Hunter, III, Wesleyan University. (Lantern; 10 min.)

Data are presented to substantiate the proposal that 2 species of Clinostomum, a fish-bird form and a frog-bird form exist. Over a period of 4 years, examinations during June, July, and August of 1296 fresh-water fish of 11 species indicate a 9.4, 7.9, and 12 per cent infection, respectively, with the metacercaria of C. marginatum; 302 frogs of 4 species examined during the past 2 years yielded a 5.6 per cent infection with C. attenuatum. Two of these hosts, Rana palustris and R. clamitans are new; immature C. marginatum are reported for the first time from the mouth of common tern, Sterna hirundo.

Morphological differences separate the 2 species. These are substantiated by preliminary feeding experiments with the bittern, Botaurus lentiginosus, a definitive host of C. attenuatum, the following results being obtained: 1) The metacercaria of C. marginatum does not establish itself in young or adult bittern. 2) After reaching the definitive host, a period of 3 to 5 days is necessary before C. attenuatum becomes sexually mature. 3) This parasite maintains itself in the final host for 2 to 4 weeks. 4) The eggs of C. attenuatum are apparently shed directly from the mouth of the bittern into the water.

By title

198. THE LYMPH SYSTEM OF ZYGOCOTYLE LUNATUM WITH A NOTE ON THE SUBFAMILY ZYGOCOTYLINAE. Charles H. Willey, New York University.

Through the kindness of Dr. M. C. Hall, chief of the Zoological Division, Bureau of Animal Industry, several specimens of Zygocotyle lunatum were loaned to me for study. This material was collected from 3 host species, Anas boschas, Anser anser, and Bos taurus. Price ('28) has shown that Zygocotyle lunatum occurs in both birds and mammals. The lymph system in the material examined consists of a single pair of longitudinal vessels dorsal and slightly medial to the intestinal caeca with branches to various body organs. Bhalerao ('31), in a revision of the diagnosis of the subfamily Zygocotylinae to contain the new genus and species Stunkardia dilymphosa, described the subfamily as containing parasites of only reptiles and birds and as having a lymph system consisting of a pair of dorsal and a pair of ventral canals. On the basis of the host relationships as demonstrated by Price, and on the basis of the morphology of the lymph system as here reported for Zygocotyle, the type genus, the diagnosis of the subfamily as modified by Bhalerao must be revised.

199. THE FILARIID PARASITES (NEMATODA) OF AMPHIBIA. A. C. Walton, Knox College.

Records of 45 species representing 12 genera, and 6 subfamilies of 4 families of the order Filarioidea are presented as being reported from 37 species of Amphibia. Records from all the continents are presented and most of the major groups of Amphibia are apparently parasitized by Nematodes of this order. Several new species are described and figured, as well as the hitherto unrecorded males of 2 species of Foleyella.

Synonymy of host as well as of parasite scientific names is discussed and brought in line with modern usage.

ECOLOGY

Read

200. A CONSIDERATION OF THE FAUNAL AREAS OF SOUTHERN ARIZONA BASED ON THE DISTRIBUTION OF AMPHIBIANS AND REPTILES. Howard K. Gloyd, University of Michigan. (Introduced by the Secretary of the Society.) Lantern; 15 min.)

From a collection of approximately 1100 specimens of amphibians and reptiles and from field observations made during the summers of 1930 and 1931, 3 'faunal areas' differing from each other in their herpetological populations and in certain climatological and physiographic respects, have been defined in that portion of Arizona south of the Gila River. All appear to be subdivisions of the Lower Sonoran life zone. From west to east across that portion of the State, the following areas are recognized: 1) a Western Desert Area of low elevation, high average mean temperatures, and extremely low rainfall, including the lower Colorado and Gila valleys and extending eastward to the vicinity of

Ajo; 2) a Central Desert Area, with a gradual increase in elevation, lower average mean temperatures, and increased rainfall, from the Ajo region eastward to the Santa Catalina and Santa Rita Mountains; and, 3) an Eastern Plains Area, still higher in elevation, with lower mean temperatures and a considerable increase in rainfall, occupying the southeastern corner of the State south of the Arizona Plateau and westward to the mountain ranges mentioned above. Each of these regions possesses a group of indigenous species, the Central Area having the richest amphibian and reptilian fauna since, in addition to its own endemic forms, it shares with the adjoining areas a considerable number of others. The species indigenous to the Central Area appear to have reached it from the south as a result of the northward spreading of certain forms of the western edge of the Mexican Plateau.

201. Life of West Virginia caves. Albert M. Reese, West Virginia University. (Lantern; 5 min.)

With the aid of a grant from the American Association for the Advancement of Science, 41 caves in the limestone regions of the State were visited and collections made of the animals found in each. A list of these animals will be published when they have been examined and identified by specialists; also brief descriptions of the caves.

Cave crickets and certain Diptera were found in practically all caves; bats in a majority of the caves; fish and salamanders in a few caves.

No blind fish were found. Blind beetles were the only blind animals seen.

202. A method of marking living snakes for future recognition, with a discussion of some problems and results. Frank N. Blanchard, University of Michigan, and Ethel B. Finster, Asheville Normal School. (Lantern; 15 min.)

The method devised for marking living snakes consists in cutting off certain scales under the tail. The positions of these marks are recorded as in the left or right series of subcaudals and as so many scales posterior to the anus. Thus, 2–4, 7 refers to a snake on which the second left and the fourth and seventh right caudal scutes have been removed. The mutilated scale tends to regenerate, but a permanent scar remains if a considerable portion of the scale has been removed, even though the wound is so superficial that it does not draw blood. This plan provides for positive identification of individuals for at least several years. Although final conclusions cannot yet be drawn, the few 'returns' from several hundred garter snakes marked and released in the vicinity of the University of Michigan Biological Station in northern Michigan since 1929 indicate little, if any, significant difference in rate of growth between the sexes, a diminishing rate with age and a much faster growth during June and July than in other months. Even preliminary conclusions are not yet attempted on other species, and on other problems under investigation, such as extent of wanderings, rate of growth of young snakes, relation of size to age and length of life of individuals.

203. The role of copper in the setting and distribution of the oyster. Herbert F. Prytherch, U. S. Bureau of Fisheries. (Lantern; 15 min.)

Copper is the only known chemical element that will induce setting or attachment of the larval oyster. Under natural conditions, copper is most effective in amounts varying from 0.15 mg. to 0.50 mg. per liter. Within this range, the intensity of setting or number of larvae responding to copper stimulation is directly proportional to the amount of copper present. Surface and underground waters dissolve copper from the land and transport it to the sea. In brackish water a colloidal precipitate of copper oxychloride is formed which after ingestion by the larva initiates the setting process after an average latent period of 4 minutes and 20 seconds. The duration of the setting process varies in waters of different salinity and reaches its optimum or shortest interval in salt concentrations of 16 to 18.6 per mille, when attachment is completed in from 12 to 19 minutes. The subsequent metamorphosis of the attached larva and its development into a spat is dependent upon the ingestion of additional amounts of copper, which initiates the breaking up of the pigment spots and the passage of several hundred pigmented leucocytes into the blood stream. The horizontal and vertical distribution of oysters in different coastal regions can be correlated with the copper content, salinity of the water and the variations in these factors under different hydrographical and tidal conditions.

By demonstration

204. Apparatus used in the study of spawning and of larval distribution of oysters. T. C. Nelson, Rutgers University.

Oyster larvae are distributed vertically in response to speed of current and to the degree of the salinity gradient. Usual methods of plankton sampling are deficient in that only one depth can be sampled at a time. A copper cylinder subdivided into 4 chambers each with 10 liters' capacity, and with entry ports situated 0.2 meter apart permits simultaneous sampling at 4 depths. Each port contains a thimble of 200-mesh monel metal screen which filters the net plankton from the water as it enters the chamber. Current speed is determined simultaneously at 3 depths by a self-recording differential current meter consisting of 3 independent meters recording electrically on a kymograph. Temperatures are obtained with reversing thermometers and with a submersible thermograph.

By title

205. A study of the vertical distribution of Euglena. R. P. Cowles, Johns Hopkins University.

Euglena sanguinea Ehrenb. and an unidentified species of green euglena from a sphagnum swamp near Woods Hole, Massachusetts, were studied in this investigation. The euglenas were cultured in various ways in the laboratory and observations were made on their habits and distribution under these artificial conditions; then observations were made on their habits and distribution in the swamp; and finally quantitative determinations of their vertical distribution were undertaken in pools in the swamp.

It was found that the vertical and the horizontal distribution in cultures in the laboratory are quite different from those in the swamp; that at all times of the day, even with oncoming darkness, and under all sorts of weather conditions, the numbers of active euglena, as well as those which make up the 'bloom,' are much greater at the surface of the pools than at lower levels; that the numbers of active individuals decrease, irregularly, however, with the depth; that the effect of a heavy rain usually results in a great increase in active euglenas at the surface of the water and a great decrease in active euglenas at lower levels; and that, while sunlight is an important factor regulating vertical distribution, there are other factors which must be taken into consideration.

206. On the taxonomic status, range, and natural history of Schott's whipsnake, Masticophis schotti schotti (Baird and Girard). Howard K. Gloyd and Roger Conant, University of Michigan and Toledo Zoological Society. (Introduced by Frank N. Blanchard.)

Schott's racer, described by Baird and Girard in 1853, until very recently was known only from the type specimen in the U. S. National Museum. When the genus Masticophis was monographed by Ortenburger in 1928, only 2 additional specimens, each without definite locality, were available. The accumulation of a series of over 30 individuals during the past 3 years has made a detailed study of this form possible. Although specimens from the edge of the Edwards Plateau of south-central Texas, the northern extremity of its range, show tendencies in color pattern toward Masticophis taeniatus girardi, the closest affinity in that region, no strong evidence of intergradation could be detected. A considerable series of specimens from the lower Rio Grande Valley, however, show definite intergradation between M. schotti and M. ruthveni Ortenburger, '23, in that area. In order to express this relationship, it is suggested that trinomials be employed and that these forms be known as Masticophis schotti schotti (Baird and Girard) and Masticophis schotti ruthveni (Ortenburger).

The increased amount of material now available indicates that the range of this species can be defined as the Mesquite and Desert Grass Savannah of the higher portions of the Gulf Coastal Plain of southern Texas, from the southern edge of the Edwards Plateau in the north, southward, and westward to the valley of the Rio Grande.

Observations on the habitat, habits, food, and egg laying of this species are recorded.

207. Notes on the seasonal movements of some cave bats. Mary J. Guthrie, University of Missouri.

Frequent collections of bats from 2 limestone caves in Boone County, Missouri, from March, 1931, to July, 1932, revealed that 6 species were cave inhabitants in this region. Myotis grisescens is a summer resident, appearing about the middle of June and leaving during October. Myotis sodalis is found during the period beginning in mid-October and ending in February or March, depending on the season. There is considerable evidence of a changing population except during December ('31) and of group movements following unsea-

sonal breaks in winter temperatures. Myotis lucifugus lucifugus is present in a torpid condition from the end of November until mid-January ('32). From then until mid-April, when all have left the caves, there are definite indications of migration in changing numbers and ages of animals. Myotis keenii septentrionalis, taken only on February 6, 1932, is a migrant which usually does not stop in this region. Pipistrellus subflavus subflavus is a conspicuous hibernating resident, remaining in the caves in a dormant condition from mid-October to mid-January ('32) when some migrants appeared. Until the early part of May, group movements are detectable. At that time, the females leave the caves, but the males remain until June. Eptesicus fuscus fuscus usually does not penetrate beyond the open-entrance regions of the caves visited. Males were found from October until March, but females were taken only from November to January. A correlation is suggested between seasonal movements and temperature, although it is not supposed that temperature is the only conditioning factor.

MISCELLANEOUS AND LATE PAPERS

Read

208. A COMPARISON OF THE LIFE HISTORIES OF THE TWO KINDS OF FEMALES IN THE ROTIFER, HYDATINA SENTA. Josephine Carolyn Ferris, University of Nebraska. (Introduced by D. D. Whitney.) (Lantern; 10 min.)

The life history of the rotifer, Hydatina senta, involves the production of 2 kinds of females, amictic and mictic. The average hatching period is about 22 hours at a temperature of 16° to 17°C. The prefecund period extends over a period of about 42 hours. During the fecund period the mictic females produce on the average 42 offspring, extending over a period of about 54+ hours, whereas the amictic females produce on the average of 45 offspring over a period of about 81+ hours. The mictic females require on the average about 26 hours less to produce practically the same number of offspring as the amictic females. The total length of life of the amictic female is 192 hours, while that of the mictic female is 170 hours.

The consequent shortening of the total life period, due to the rapid deposition of eggs, on the part of the mictic females and the difference in comparison with the amictic females, may indicate a difference in their rates of metabolism.

209. NEW MUTATIONS IN DROSOPHILA OBSCURA, RACE B. Catherine V. Beers, University of Southern California. (Introduced by the Secretary of Section F.) (15 min.)

No abstract received.

210. UNIQUE REPRODUCTIVE FEATURES IN THE KILLIFISHES OF THE MEXICAN PLATEAU. C. L. Turner, Northwestern University. (Introduced by the Secretary of the Society.) (Lantern; 15 min.) (Also by demonstration.)

The Goodiidae, a family of top minnows confined to a range within the Mexican Plateau, have developed several unique reproductive features which separate them sharply from the lowland top minnows (Platypoecilous, Xiphophorus, Mollienesia, etc.)

In the lowland type a large yolk sac is developed. Fertilization is internal, the fertilized egg and later the embryo remain in the ovarian follicle until time for birth.

In the Goodiidae a very small yolk mass is developed. The young embryos remain in the follicle for only a short time, during which almost all of the yolk is absorbed. In the meantime the embryo develops a complement of long filaments from the lip of the proctodoeum. The embryo leaves the follicle at this early stage and remains in the intra-ovarian space. The nutritive filaments undergo elaborate development and the ovary becomes temporarily nutritive rather than ovigerous.

These unique nutritive filaments are confined exclusively to this family of fishes.

The filaments occur in all 8 genera of this family. Generic differences, however, are extreme. In the most extreme form the filaments are as long as the embryo, have an ectodermal cuboidal epithelium, an elaborate serous space which is inserted for some distance into the submucosa of the intestine, a central core of mesenchyme covered by blood capillaries, and a well-defined blood system connected in part with the hepatic portal system.

Reproduction in the Goodiidae is interpreted as an ovoviviparity comparable to that of lowland top minnows with a superimposed viviparity.

By demonstration

211. THE TECHNIC OF HANDLING ZEBRA FISH (BRACHYDANIO RERIO) FOR THE PRODUCTION OF EGGS WHICH ARE UNUSALLY FAVORABLE FOR EMBRYOLOGICAL AND PHYSIOLOGICAL RESEARCH AND ARE AVAILABLE AT ANY SPECIFIED TIME THROUGHOUT THE YEAR. Charles W. Creaser, College of the City of Detroit.

An attempt will be made to demonstrate the technic of rearing this fish, spawning it, and a series of the developmental stages of its living egg. This technic utilizes only one divided balanced aquarium of a size $6\times9\times26$ provided with a thermostatic heating unit (Westinghouse) and a breeding jar designed for the purpose. About 20 males are held in one section of the tank and about 20 females in the other, and the water kept at 75° to 80°F. When eggs are desired, a ripe female and 2 mature males (one if the spawning behavior is to be observed) are placed in the breeding jar and left for some time. The temperature is then increased to 85°F. by means of an electric light and the jar exposed to full sunlight or sunlight lamp. During each spawning act 5 to 10 eggs are released. A female 1¼ inches long may deposit as many as 95 eggs in 15 to 30 minutes. These are 1.2 mm. in diameter, transparent, and non-adhesive. They may be removed with a pipette from the collection chamber and placed on a watch glass while the fish are still spawning. Development starts at once and the 8-cell stage in a regular development is reached in 30 minutes. Hatching takes place in about 76 hours at a temperature of 80°F. A high percentage of fertilization is obtained and about 50 per cent will hatch when reared under the microscope with the least of care and experience.

212. THE LAW OF EVOLUTION AND ITS RELATION TO OTHER LAWS OF KINETIC SYSTEMS. W. H. Longley, Goucher College.

Evolution is process of growth of a second-order population, or population of populations, such as all the individuals in a great natural group of species collectively compose. It is as much subject to law as is the growth of simple populations, which may be expressed graphically by the logistic curve.

The laws of growth of second-and first-order populations are both laws of the same general sort as the gas laws. They are laws of physical systems whose units are active and act upon one another at random. The essential difference between normal gases and the 2 types of population is that in the former the units may neither reproduce nor vary, while in simple populations they reproduce but do not vary significantly, and in second-order populations they both reproduce and vary.

Systems whose units vary, but do not reproduce, are exemplified in glowing gases.

All 4 types of system are naturally associated under the terms of an amplified kinetic theory as soon as it is recognized that the primary characteristic of a kinetic system, as the term is here used, is that its units are active and act at random on others. The capacity of the unit for reproduction or variation is of secondary concern. This is true also of the nature of the influence unit exercises upon unit. These factors merely modify in detail processes of adjustment constantly occurring in the several systems and expressed in laws of which the gas laws are prototypes.

213. THE EFFECTS OF CERTAIN HORMONES ON THE OVARIES OF ARMADILLOS IN THE FREE-VESICLE STAGE. G. W. D. Hamlett, Indiana University.

Three extracts were injected into females of the 9-banded armadillo in an attempt to produce early implantation of the free blastocyst. The hormones used were a luteal extract, furnished by the Eli Lilly Company, and extracts of whole pituitary and antuitrin-s, furnished by Parke-Davis & Company. None of the extracts caused implantation, but the effects of the 2 latter on the ovaries was very marked. Both enlarged the ovaries to 5 or 10 times the normal bulk, this being caused largely by cystic enlargement of the follicles. There was some luteinizing of unruptured follicles, this being especially marked with the whole pituitary extract.

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NOTICES BY F. E. WELLS

AN ELEMENTARY PSYCHOLOGY OF THE ABNORMAL, by W. B. Pillsbury. 1932. Size, $5\frac{1}{2} \times 8\frac{1}{4}$ inches. Pages x + 375. Subject and author indices. 7 illustrations. Buckram. Price, $3.00. McGraw-Hill Book Company, New York.

To the college student or the layman this book presents the aspects of abnormal mental life that are likely to interest or affect him. It shows how abnormal phenomena are related to normal and points out how study of abnormality helps in understanding the normal. It contains the more important suggestions that have been made for mental hygiene. In general, the presentation follows the hostorical order, since that is also the logical order, from hypnotism to the latest theories. It includes, of course, Freud and his system and the modifications of this system introduced by Jung and Adler. Kinds of insanity are described with illustrative case histories, and the causes of insanity are considered. The final chapter on mental hygiene gives wholesome counsel for prevention and treatment.

EVOLUTIONIST AND MISSIONARY JOHN THOMAS GULICK Portrayed through Documents and Discussions, by Addison Gulick. 1932. Size, $6\frac{1}{4} \times 9\frac{1}{4}$ inches. Pages xvi + 556. Illustrated with 37 figures and 3 plates. Bibliography. Index. Cloth. Price, $4.00. University of Chicago Press, Chicago.

The biography of this great biologist and philosopher is told as far as was possible by his own words preserved in journals, letters, and other writings. He was of Dutch and Puritan ancestry and was born in Hawaii, where his missionary parents were engaged in making the heathen natives into Presbyterians. He tells of his boyhood spent on the islands, of his visits to the United States and the gold fields of California, of his college days, of his travels through the Orient as a missionary, and of his biological research. His observations on the land snails, Achatinelli, first stirred his interest in evolution when he came to the conclusion that "all these Achatinelli never came from Noah's ark." His entire scientific life proceeds as an orderly development from his studies on snails. Using the mass of data collected on them he undertook to test and rework the conceptions upon which Darwinism had been based. A life rich and productive is revealed in this book. In addition to his biological writings, he has a number of religious and miscellaneous publications to his credit.

HANDBUCH DER BIOLOGISCHEN ARBEITSMETHODEN, Lieferung 383. Edited by Emil Abderhalden. Abt. VIII, Methoden der experimentellen morphologischen Forschung, Teil 1, Heft 7. 1932. Size, 7 × 10 inches. Pages

1289 to 1402. One illustration. Price, RM 6.20. Urban und Schwarzenberg, Berlin and Vienna.

Two articles are contained in this issue: Die morphologischen Methoden zur Untersuchung der Schilddrüse, by Carl Wegelin; and Die Methoden zur Untersuchung des retikuloendothelialen Systems und des Mesenchyms, by Franz Bruman. Each paper is followed by a list of references cited.

HANDBUCH DER BIOLOGISCHEN ARBEITSMETHODEN, Lieferung 386. Edited by Emil Abderhalden. Abt. VIII. Methoden der experimentellen morphologische Forschung, Teil 1, Heft 8. Verfahren zur Untersuchung des Knochens, des Knorpels und der Gelenke, by F. J. Lang and L. Haslhofer. 1932. Size, 7 × 10 inches. Pages 1402 to 1540, inclusive. Illustrated with 23 text figures and 2 colored plates. Bibliography. Price, RM 8.50. Urban und Schwarzenberg, Berlin and Vienna.

DIE ERNÄHRUNG DES HERZENS UND DIE FOLGEN IHRER STÖRUNG, by Luigi Condorelli. (Ergebnisse der Kreislaufforschung, Band III, herausgegeben von Bruno Kisch.) 1932. Size, 6¼ × 9¼ inches. Pages xii + 230. 70 illustrations, some of them in colors. Bibliography. Subject and author indices. Price, RM 18.80; bound, RM 20. Theodor Steinkopff, Dresden and Leipzig.

A study of the cardiac circulation which describes the anatomy and the physiology of arteries, veins, and lymph vessels; discusses experimental research on hearts, both isolated and in situ; and devotes the greater part of the pages to pathological heart conditions in man.

ÉLÉMENTS D'HISTOLOGIE, Vol. II, by P. Bouin. 1932. Size, 11 × 9 inches. 580 pages. Illustrated with 385 text figures and two colored plates. List of references following each chapter. Price, 200 francs. Librairie Félix Alcan, Paris.

The author has not confined his subject to morphological description. He has included details of general biological problems and questions of histophysiology such as the physicochemical makeup of protoplasm, the differentiation of cells, the functioning of the endocrine glands, and the oestrous cycle in mammals. He emphasizes anatomical structure by study of physiological function. This volume, the second of the set, deals with cells, tissues, and organs necessary to nutrition, digestion, respiration, excretion, and reproduction; also the endocrine glands, the nervous system, and the organs of special sense. The excellent illustrations add much to the book's value.

NEW BOOKS AND PUBLICATIONS

NOTICES BY F. E. WELLS

RECENT ADVANCES IN CYTOLOGY, by C. D. Darlington, with a foreword by J. B. S. Haldane. 1932. Size, $5\frac{1}{2} \times 8\frac{1}{4}$ inches. Pages xviii + 559. Illustrated with 8 plates, 109 text figures, and 66 tables. Glossary. Bibliography. Index. Cloth. Price, $4.00. P. Blakiston's Son & Co., Inc., Philadelphia.

In the foreword, J. B. S. Haldane says of this book: "It should properly, I think, be termed a treatise on karyology, the study of the nucleus, rather than cytology, of which karyology is a part. For no mention is made of extranuclear constituents of the cell except in their relation to the nucleus. In karyology it marks the beginning of a new epoch, the transition from an essentially descriptive to a largely deductive science." The book consists of three elements: an introduction for the student who is a beginner, a résumé for the research worker who requires classified observations, and a theoretical treatise in which the author develops his own views for the general biologist. While some of his conclusions may not be accepted, they merit careful reading and thoughtful consideration.

MENTAL DEFICIENCY DUE TO BIRTH INJURIES, by Edgar A. Doll, Winthrop M. Phelps, and Ruth Taylor Melcher. 1932. Size, $5\frac{3}{4} \times 8\frac{3}{4}$ inches. Pages xv + 289. 26 illustrations. Bibliography. Index. Cloth. Price, $4.50. The Macmillan Company, New York.

The work reported in this book was undertaken in the belief that normal mentality might exist even in extreme degrees of dyskinesia; and with the hope that training and reeducation of the muscles would release mental abilities lying dormant without means of expression. The twelve patients discussed in the present volume were selected as cases of mental deficiency more or less traceable to cerebral injuries sustained at birth, and were given physical therapy with varying degrees of success. The book contains full information regarding birth and developmental histories, mental tests, measures, estimates, and growth, describes the educative treatments and the improvement or lack of improvement shown in each case. Results and conclusions are summarized in the last chapter.

BAILEY'S TEXTBOOK OF HISTOLOGY (Eighth Edition), revised and rewritten by Adolph Elwyn and Oliver S. Strong, with the collaboration of Philip E. Smith, Aura E. Severinghaus, Wilfred M. Copenhaver, Russell L. Carpenter, and Charles M. Goss. 1932. Size, $6\frac{1}{4} \times 9\frac{1}{4}$ inches. Pages xvi + 746. 529 illustrations. Index. Cloth. The Williams and Wilkins Company, Baltimore.

The eighth edition of this standard textbook concludes the revision which was partially completed in the previous (seventh) edition. The chapters on the organs have been entirely rewritten and a new chapter on the living cell has been added in which are discussed methods employed in the study of living tissues and certain important findings discovered by the use of these methods. Some of the material on nerve tissue, the nervous system, and organs of special sense has been omitted and only the portions dealing primarily with neurohistology have been retained. The first part of the book treats of the cell, the second of the formation and structure of tissues, and the third part is concerned with microscopic anatomy of organs. Physiological significance is emphasized sufficiently to correlate structure with function.

NEW BOOKS AND PUBLICATIONS

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RECENT ADVANCES IN PLANT GENETICS, by F. W. Sansome and J. Philip, with a foreword by Sir Daniel Hall. 1932. Size, $5\frac{3}{4} \times 8\frac{1}{4}$ inches. Pages x + 414. 56 illustrations and 42 tables. Index. Bibliography. Cloth. Price, $4.00. P. Blakiston's Son and Co., Inc., Philadelphia.

An exposition of recent developments of the chromosome theory, particularly during the last 10 years when the experimental study of polyploidy has done so much to confirm the general hypothesis. It gives a perspective of plant genetics, shows how it has developed and is now developing. The book is intended for the teacher, the research geneticist and the general biologist, and its resume should do much to remedy the lack of contact between the plant and animal branches of the science, since many of the phenomena it deals with, while largely peculiar to the plant kingdom, are of great significance for the general theory of genetics.

AN INTRODUCTION TO ZOÖLOGY, through the Study of the Vertebrates with Special Reference to the Rat and Man, by Zeno Payne Metcalf. 1932. Size, $6\frac{1}{2} \times 9\frac{1}{2}$ inches. Pages xix + 425. 184 illustrations and 5 diagrams. Index. Cloth. Price, $3.50. Charles C. Thomas, Springfield and Baltimore.

This text book for beginners introduces students to the science of zoölogy through a study of the vertebrates with special reference to the mammals. The reasons for this method of approach are given by the author as follows: the student is interested chiefly in the vertebrates, is more or less familiar with much of their natural history, and is not entirely unfamiliar with their anatomy and physiology, especially that of birds and mammals. In addition to a thorough study of the vertebrates from the standpoins of anatomy and physiology the animals should be studied from the viewpoint of their relations to man. The whole course is thereby vitalized, and interest is not hard to maintain. The divisions of the book conform to the natural divisions of a course in introductory zoölogy: 1) a general introduction, 2) the study of the detailed anatomy and physiology of a mammal, 3) the broader aspects of zoölogy. The rat has been chosen as a type animal rather than a lower vertebrate because its structure more nearly resembles our own. Related structures are grouped together and studied as to form and function. The illustrations supplement the text giving vivid pictures of the objects described.

DIE ELEKTRIZITÄT IN DER ZELLE, by Rudolf Keller. Third Edition. 1932. Size, $6\frac{1}{4} \times 9\frac{1}{4}$ inches. 322 pages. 28 illustrations. Tables. Subject and author indexes. Cloth. Julius Kittls Nachfolger, Mährisch-Ostrau.

During the 7 years since the Second Edition was issued knowledge of electricity in organic substances has greatly increased. This edition has been prepared to bring the subject up to date. It is divided into 3 parts—general, animal, and plant.

ANATOMIE DES MENSCHEN. Ein Lehrbuch für Studierende und Ärzte, von Hermann Braus. Dritter Band, Centrales Nervensystem, von Curt Elze. 1932. Size, $6\frac{3}{4} \times 10$ inches. Pages vii + 234. 126 illustrations, some of them in color. Index. Cloth. Price, RM 14.80. Julius Springer, Berlin.

This volume of the series is devoted entirely to the central nervous system. The organs of special sense will be treated in Volume Four, not yet published. The author has selected and presented the material to give a simple and uniform picture of the central nervous system and the peripheral nerve connections.

THE EXPERIMENTAL ANALYSIS OF DEVELOPMENT, by Bernhard Dürken. Translated by H. G. and A. M. Newth. 1932. Size, 5¾ × 9 inches. 288 pages. 120 illustrations. Bibliography. Index. Cloth. Price, $4.75. W. W. Norton and Company, Inc., New York.

The author states in the preface that "Experimental analysis of development has become an indispensable part of biology" although many biologists and medical men are quite unaware of the problems and conclusions of this branch of study. The present book is designed to remedy that lack of awareness. It covers the entire field, presenting concisely its great problems rather than its particular results, and serves as an introduction to experimental embryology leading to the study of more comprehensive works. It was originally published in German under the title of "Grundriss der Entwicklungsmechanik" and in making the English version the translators have sought to retain the literal meaning of the author. Among the problems mentioned are fertilization and the stimulus to development, presumptive organ regions and the kinematics of early development, potency, determination, influence of environment, interrelations concerned in development, and the germ cell as a reaction basis.

ALCOHOL AND MAN. The Effects of Alcohol on Man in Health and Disease, edited by Haven Emerson. Associate editors: Henry A. Christian, Reid Hunt, Arthur Hunter, Charles C. Lieb, Walter R. Miles, Ernest G. Stillman. 1932. Size, 6¼ × 9½ inches. Pages xi + 451. Glossary. Subject and author indexes. Lists of references. Cloth. Price, $3.50. The Macmillan Company, New York.

Regardless of current controversies regarding the eighteenth amendment and the subsequent enforcing acts, the authors and editors of this book have given facts, and opinions supported by facts, about alcohol in its biological and human relationships. From the preface: "Beginning with fundamental information gathered by biologists upon the effect of alcohol on simple unicellular organisms, and upon the germ cell, and in genetics and inheritance, we present the contributions of the basic medical sciences to our present understanding of the actions of alcohol on the normal experimental animal and upon man, in moderate, toxic, and therapeutic doses, the damage done by alcohol to man's resistance to disease, to his body tissues, and the benefits which may accrue from the judicious medical administration of the drug to the sick. Especial pains have been taken to present the exquisite and ingenious studies upon the effects of alcohol in minute amounts upon the spirit and conduct of man, his personality, his reactions to material and social environment according to the variable elements he may have inherited or acquired in his years of psychical development. Since the major effect of alcohol is upon the mind of man the chapters on psychology and psychiatry are essential to any honest attitude toward alcohol as social problem." There is also a section on alcohol's relation to longevity, mortality and morbidity. This unbiased and authoritative collection of data from many sources is presented in such a way as to be readily understood by any educated person.

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